MACHINERY

Design—Construction—Operation

Volume 40 AUGUST, 1934 Number 12

No process of machining has gained ground more rapidly during the past year than broaching. The leading article in September MACHINERY will illustrate and describe the highly developed fixtures used in broaching independent front-wheel suspension parts for a well-known automobile. *When and where to Use Welded Designs to Replace Castings* is another important article in the September number. Bearings form the subject of still another featured article.

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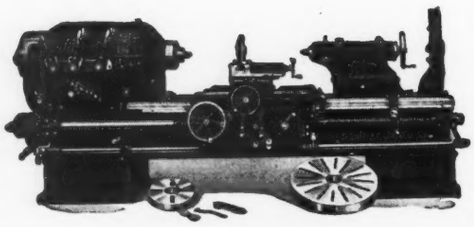

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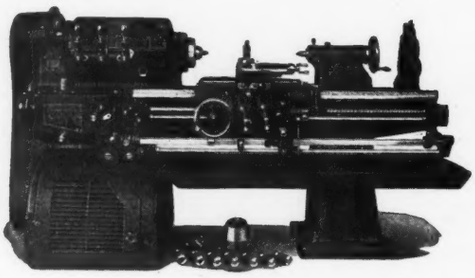

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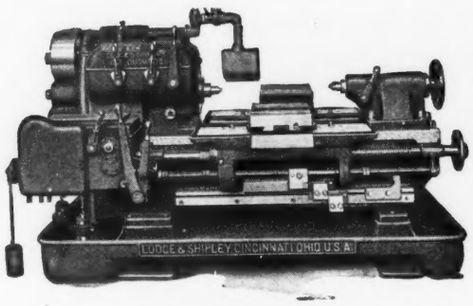

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The LODGE &

MACHINERY

Volume 40 NEW YORK, AUGUST, 1934 Number 12

Letting Vacuum Do the Inspection

By CHARLES O. HERB

Minute Errors are Readily Detected in Holes of Small Diameter by Means of Vacuum

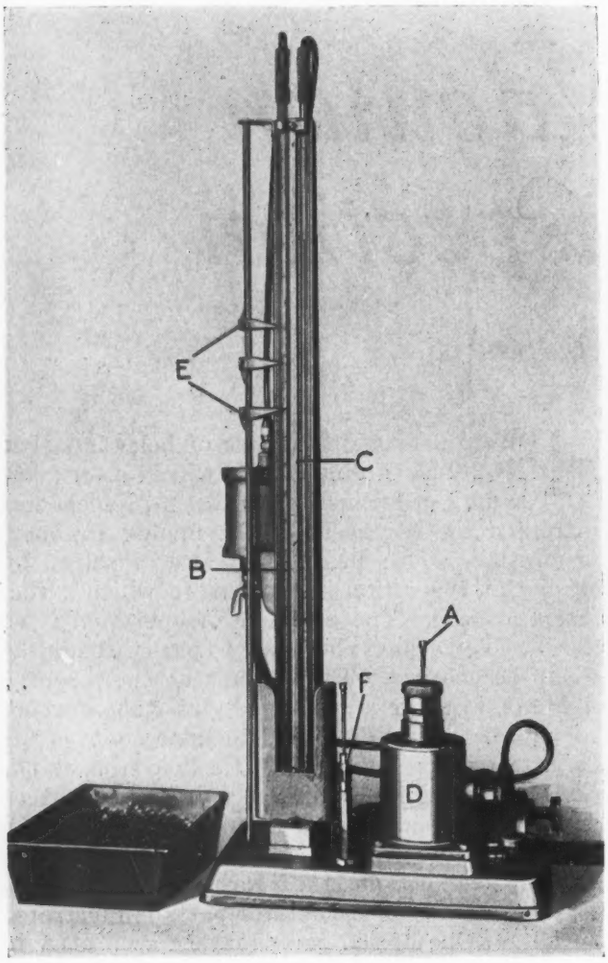
HOW to determine the size of holes less than 1/32 inch in diameter to within a ten-thousandth of an inch—this was a problem that confronted the engineers of the Bendix Products Corporation, South Bend, Ind. It was solved by devising an inspection instrument in which a vacuum is utilized. The principle of operation is as follows: The vacuum allows air to pass through the hole to be checked. The air acts on the top of a column of water in a graduated glass tube, forcing it downward. Any difference in the amount of air due to a variation in the size of the hole from standard is indicated by a difference in the height of the water in the graduated glass tube. Comparative readings are thus readily obtained.

The instrument designed for this close inspection on a number of carburetor parts is illustrated in Fig. 1. One of the parts may be seen at *A* in position for gaging. The hole being checked is produced with drills from No. 70 to 65 (from 0.028 to 0.035 inch in diameter). In drilling holes of such small sizes, a very slight wear of the drill or a minute eccentricity in its rotation may easily cause a difference of 0.001 inch in the diameter of the hole. Even so small an error would make an appreciable difference in the service for which the part is used, and so the tolerance specified is only 0.0003 inch. Because of such a close tolerance, there must be a dependable method of determining the hole diameter for its entire length. The vacuum instrument provides this method.

How Vacuum Determines the Magnitude of Errors in Small Holes

The vacuum inspection instrument illustrated in Fig. 1 consists essentially of two graduated glass tubes *B* and *C*. Tube *B* contains the water, which gives a comparative reading of the size of holes in the part, while tube *C* contains mercury that indicates the vacuum in the line. The vacuum reading is maintained at 18 inches.

Fig. 1. This Vacuum Instrument Detects Extremely Small Errors in Holes that are Less than 1/32 Inch in Diameter



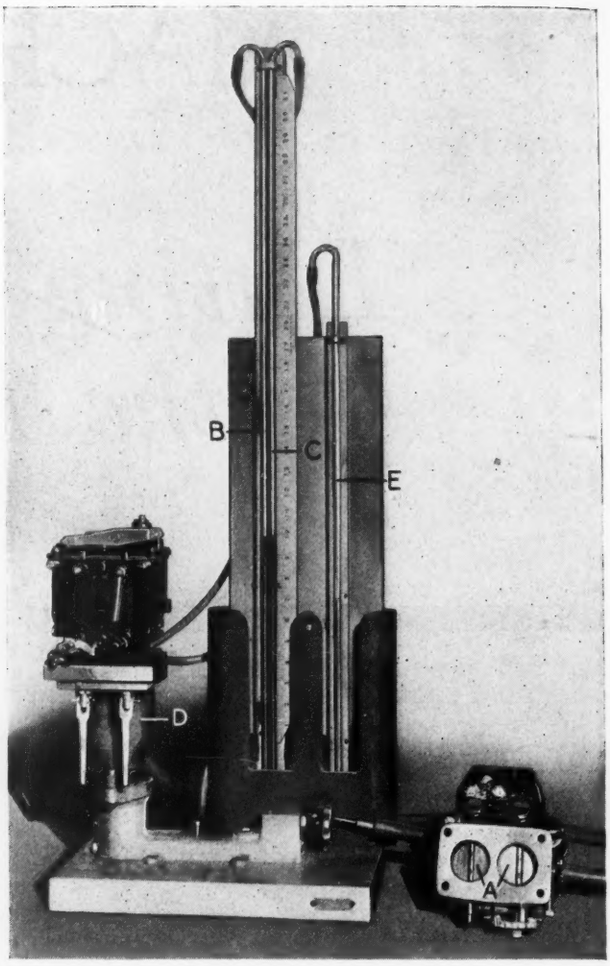


Fig. 2. Another Instrument Determines Differences in the Fit of Throttle Valves in Double-barrel Carburetors

Normally, air passes into the vacuum line to the water tube *B* through a hole in the top of unit *D*. This air forces the water in tube *B* downward to a predetermined height. When the work is inserted in unit *D*, as shown at *A*, the passage into the unit is partly closed, and the amount of air that passes into the vacuum line is then reduced an amount depending upon the size of the hole in part *A*. The reduced amount of air allows the water to rise in tube *B* to a position which gives an indication of the size of hole in the work.

For a variation of 0.001 inch in the hole diameter, the water will actually rise about 1 1/2 inches in the tube. Minute differences in the hole diameters can therefore be detected with ease. Pointers *E* are set to indicate the high and low limits to which the water may rise and the part still pass inspection. These pointers are set by inserting a master part in unit *D*.

If the hole in unit *D* were sealed by placing a finger over it, the vacuum in the line would allow the water to flow over the top of tube *B*. Before parts are inspected in this equipment, they are inserted into fitting *F* and any dirt or oil lodged in the hole to be checked is blown out by compressed air. Adjustments provide for maintaining the mercury and water at the desired heights.

Checking Double-Barreled Carburetors

Another important inspection consists of checking the fit of the two flapper throttle valves *A*, Fig. 2, of double-barreled carburetors, to make certain that both valves close completely at the same time. It was previously the custom to check the fits of these valves with the carburetor body by placing strips of thin paper between the valves and the bores in which they are assembled. The vacuum device illustrated gives far more accurate results and permits much faster inspection.

This inspection fixture is based on the same principle as the one previously described. However, it is provided with two water tubes *B* and *C*, one for each throttle valve in the carburetor. The carbu-

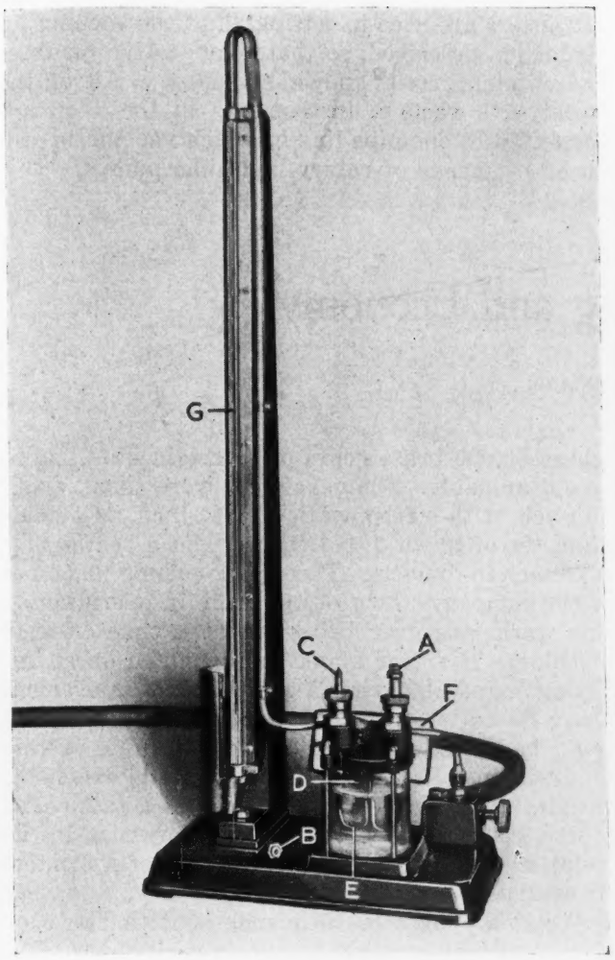
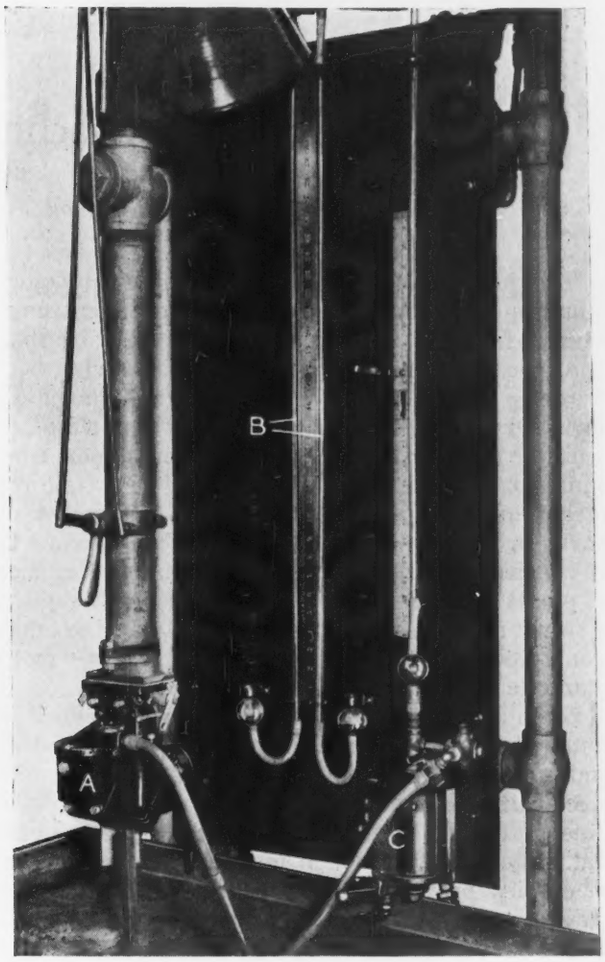


Fig. 3. Air Bubbles in Water Indicate the Accuracy of a Needle Valve Inspected by Means of This Equipment

Fig. 4. Vacuum Equipment is Also Used in Making Final Inspection and Adjustment of the Assembled Carburetors



retor is positioned on unit *D* for checking. If a difference occurs in the height of the water columns in tubes *B* and *C*, the carburetor is adjusted until the readings are identical. Tube *E* contains mercury that indicates the number of inches of vacuum in the line to the water tubes.

The heading illustration shows the inspection equipment used for checking the fit of the throttle valve in a single-barrel carburetor. This instrument is a combination of those shown in Figs. 1 and 2.

Air Bubbles Check a Pin Valve

Fig. 3 shows a duplex type of instrument designed for checking the seat of floating needle valves by the use of vacuum. One of these valves may be seen at *A* in position for inspection, while another lies on the instrument base at *B*. When there is no valve on spindle *C*, the vacuum in the space above the water in jar *D* allows air to pass through a vent in spindle *C* and down tube *E*, causing bubbles in the water.

If the valve being inspected fits snugly over the conical point of spindle *C* when a part is slipped over the spindle, as shown at *A*, the vent in the spindle will be sealed. Air cannot then be sucked through tube *E* and the bubbles will cease.

Mirror *F* at the back of the fixture enables the inspector to watch the bubbles without stooping. Tube *G* indicates the number of inches of vacuum in the line. Adjusting screws permit a variation of the vacuum.

Vacuum Also Inspects the Assembled Carburetor

Final adjustment and inspection of the assembled carburetor are also performed by the aid of vacuum equipment. Fig. 4 shows this work being done on the carburetor seen at *A*. This inspection gives a comparative reading of the amount of gasoline passing through the carburetor when the throttle valve is wide open and when it is closed or in the idling position. One of the tubes *B* is filled with

mercury and is used in checking the vacuum when the throttle valve is set in the idling position. The other tube is filled with water and is used in connection with the wide open position of the throttle valve. At *C* is a meter for determining the actual amount of gasoline passed through the carburetor.

Masters are used in setting all of the vacuum instruments described, so that comparative readings are obtained from known standards. All of the twenty-five vacuum instruments in the shop are connected to one pipe line in which vacuum is produced by means of rotary hydraulic pumps.

Multiple Machining and Economy

By C. W. HINMAN

The question of the economy of performing work simultaneously on several parts is dependent upon several factors. A die that can produce more than one piece per press stroke without materially increasing the feeding time is clearly an economical tool. Obviously, there is no economy in tooling for multiple production when the floor-to-floor time equals or is greater than the floor-to-floor time for machining one part multiplied by the number of parts produced simultaneously. Other factors to be considered in multiple machining are the number of pieces per order, how long the piece will remain a standard part, the setting up cost, and the additional tool expense necessary for handling more than one piece.

When all other conditions are favorable, and it is found that more than one piece can be inserted in and ejected from a tool in the same time that one piece can be handled in a one-piece tool, or in less time, multiple machining will usually prove economical. The extent to which multiple machining can be carried profitably, however, is sometimes misjudged. For example, a large mid-western shop had an order for drilling one hundred thousand steel blanks, with two small holes through each. The pieces were approximately 3/32 by 1/2 by 1 1/2 inches. The job was laid out for multiple drilling. A quick-action cam and leaf type jig was made for two pieces, and tried out, but was thought to be too slow.

Next a multiple jig having the same quick-acting features was made to hold six pieces. The designer was amazed to learn that the first jig holding two pieces produced 25 per cent more work than the jig made to hold six pieces in the same time. It was found that while six pieces could be ejected as quickly as two, the loading, placing, and drilling time with the six-piece jig was more than three times greater, its extra size and handling weight far offsetting the time it was supposed to gain. These and other adverse factors affect the final results in multiple work to such a high degree, that dependable formulas or rules for the application of multiple machining cannot be established.

It is astonishing how often an otherwise efficient manufacturing organization is led to try inefficient machining methods in attempting to reduce fabrication costs. An example of this occurred in a plant where 60,000 brass gears of a certain kind had to be cut annually. The gear teeth were small, about 30 pitch, with a face width of 5/32 inch, an outside diameter of about 1 1/4 inches, and a center hole 5/16 inch in diameter. Three gear-cutting machines of the company's own design were in operation on this work, one gear being cut at a time on each machine. The gear blank was mounted on an indexing mandrel having a reciprocating movement above the cutter. It was suggested that these gears could be coined in a toggle press, a press of this kind was installed and equipped with an expensive swaging die. This equipment proved a failure, of course, because the culminative compression in the metal intercepted its flow before any of the interstices at the tops of the teeth were filled.

A service engineer then suggested that two or more gear blanks might be cut on each of the original gear-cutting machines in one setting. The mandrels and the stroke of these machines were lengthened to accommodate three blanks, with the result that the output was increased over 50 per cent. A machine tool salesman then became interested in the job and proved, by an actual demonstration in a neighboring plant, that the best method for cutting such gears was to use a gear-hobbing machine. This installation proved the best, of course, as sixteen blanks could be hobbed together. In this particular case, the search for a more economical machining method was expensive, and too much time was taken in arriving at the method that was finally adopted.

In conclusion, it may be said that multiple dies are economical whenever the required output warrants their use and the stock-handling time is not unduly increased; multiple assembly pays when the parts are not put in place individually by hand, but can be automatically fed from magazines. Multiple milling also pays when the cutting interval considerably exceeds the loading and unloading time; the economy rapidly increases by adding more parts, and the limit is determined only by the strength of the machining support.

It should be remembered that a drilling or boring jig must be lifted, turned over, and otherwise manipulated by hand, and that this consumes time, whereas most other types of tools are immovably attached to the machine.

Shaving Dies for Producing Smooth-Edged Blanks

Points on the Design, Care and Operation of Shaving Dies Used in the Production of Parts for Calculating Machines and Scientific Instruments

By LOUIS PICKETT

SHAVING dies are always troublesome and their design is the subject of much discussion. When properly designed and constructed, they produce a machine-like finish on the edges of rough blanks which may have complicated shapes. In many instances, it would be impossible to maintain the accuracy and production rates attained with shaving dies by any other method.

Success in designing dies of this kind depends to a large extent on the amount of practical data at the disposal of the engineering department. Such data must be collected from the information passed on to the engineering department from the shop. How much to shave and in how many operations can best be determined from practical experience. The most important principles to be observed in designing shaving dies will be considered in this article.

A shaving die is similar in design and construction to a blanking die, with the exception that the contour of the blanked part is partly or wholly shaved by the edge of the die. When several thousand blanks must have their faces machined smooth and ordinary machining methods are too costly, shaving dies frequently provide a satisfactory solution to the production problem. These dies are found admirably suited for the production of pawls for calculating machines, lever arms, actuating cam rollers, gears and pinions for watches, parts for electrical clocks, parts for scientific instruments, small cams, etc., and wherever it is necessary that the edge of a piece be smooth. To obtain the best results with shaving dies, their application should be limited to metal blanks.

There are three general types of shaving dies. Although all three types are employed, the first two are the most popular and widely used. The first type is similar to an ordinary blanking die, except that it has nests to hold and locate the pieces to be shaved. The piece is shaved by being pushed through the die by the punch. The second type is constructed like a compound die, that is, the piece to be shaved is laid on the punch in the lower member. When the die comes down, the shaved piece goes up into the die and is discharged from it by the shedder.

The third and perhaps the least commonly used type of shaving die is similar to the first (the blanking die type), only the punch does not enter the die. Each consecutive piece forces the preceding piece into the die a distance approximately equivalent to one-half the thickness of the material. This type of die has the advantage that the punch does not have to be fitted into the die, as it does not enter the die opening. Thus danger of shearing the punch is eliminated, but the application is limited to comparatively heavy material (nothing less than 3/32 inch thick), because of the critical adjustment necessary on the ram of the press.

How Shaving Dies are Fitted and Sharpened

In the first two types of shaving dies described, it is necessary that the punch be a very good fit. The clearance between the punch and die should not exceed 0.0005 inch all around. A shaving die has very little cleavage clearance or taper per height of die. This increases the life of the die and produces smoother blanks. Some designers prefer to have the cutting portion extend the full height of the die. In this case, the taper should only be 0.001 inch per inch of height. Others prefer to have the cutting portion only about 1/2 inch thick, the remainder of the die being relieved with a 1/2-degree taper.

Combining Burnishing with Shaving Operation

Since the blanks are forced into the die, due to the small amount of cleavage clearance, it can be said that they are burnished after shaving, thus producing a polished finish. For this reason, it is essential that the face of the die be very smooth. All file marks should be removed before hardening and the die should be stoned to a high polish after hardening. A rough die face produces marred blanks, as the metal is torn in passing out or through the die.

The die should always be kept sharp. Care must be exercised to see that the grinding wheel leaves a smooth cutting edge. Honing the surface of the die after grinding produces a fine cutting edge which gives even more satisfactory results. Before designing a shaving die, the following points must be carefully considered:

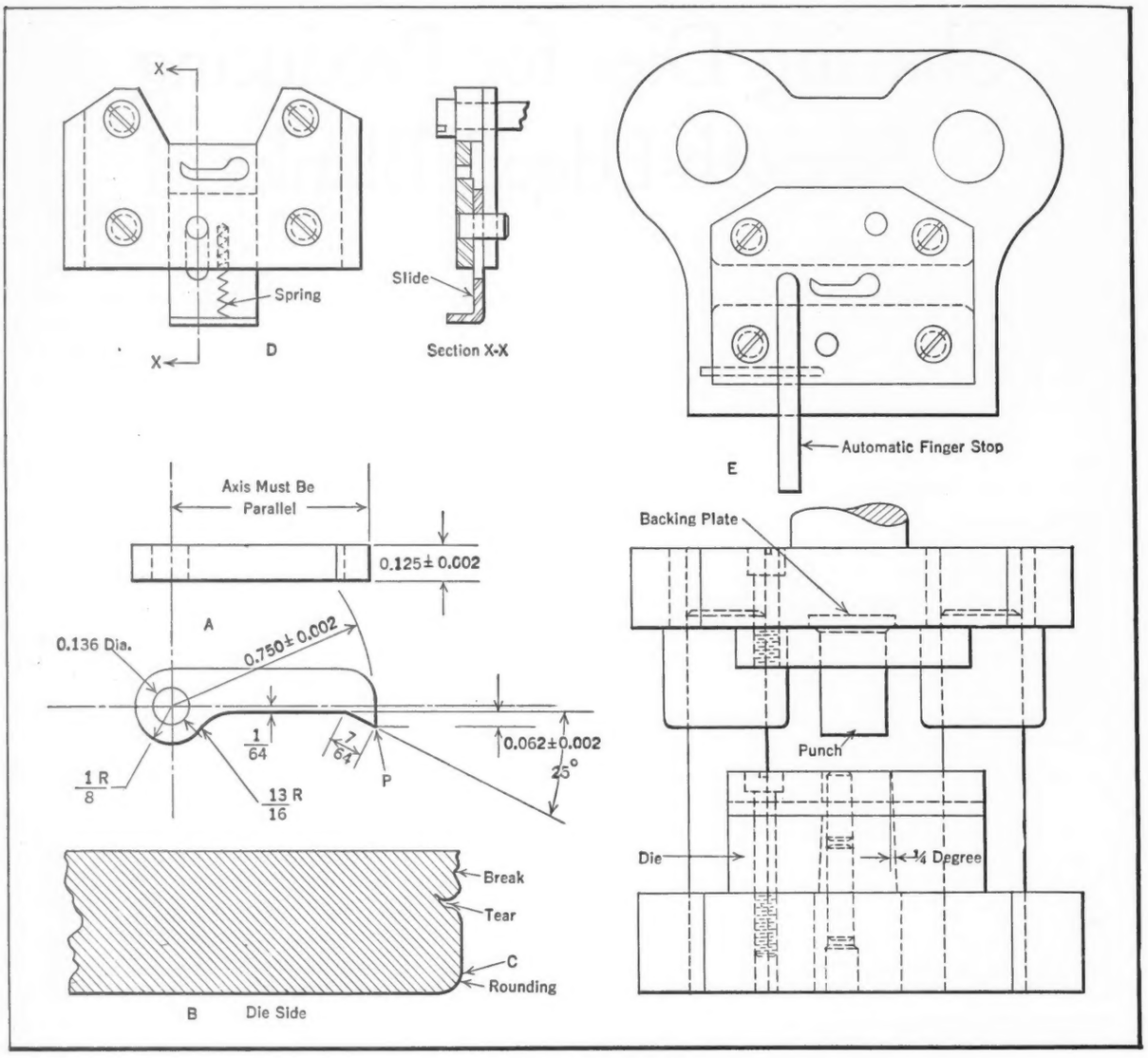


Fig. 1. (A) Blanked and Shaved Ratchet Pawl; (B) Enlarged Section of Rough Blank; (D) Nest Used for Rough-shaving Blank after it is Swaged to Required Thickness; (E) Blanking and Rough-shaving Die

1. Tolerances shown on blueprint of piece.
2. The kind and grade of material to be shaved.
3. The position of the holes in the piece, that is, how close to the edge of the blank they are.
4. How much of the piece is to be shaved.
5. The grade of finish required.
6. How the piece is to be located in the shaving die.

The type of die to be chosen will depend upon the preference of the engineering department or the specification of the customer.

How Much to Allow for Shaving

The next thing to consider is the amount to be shaved. This is a very important point. The amount will depend upon the finish desired and the thickness and hardness of the metal. No definite rule can be given as to how much larger the blank should be made than the finished product after shaving. For best results, one must rely upon past experience and judgment.

Quite often when very accurate and uniform blanks are desired, more than one shaving die is used, three being the limit. In this case, the amount to be shaved is allotted to two shaving dies in a manner similar to this: The first die will shave 0.007 inch all around, and the second 0.002 inch. Whenever more than one operation is used, the last operation should not shave more than 0.002 inch all around or a "break" will appear on the edge of the metal.

The blanks produced by a blanking die have very rough and ragged edges, because of the fact that they are torn away from the strip, due to the clearance between the punch and die. The view at *A*, Fig. 1, illustrates a shaved blank. At *B* is an enlarged view of a section of a blanked piece showing

a "tear" or "break," as it is commonly called. Every one familiar with die work knows that the edges of the die side of a blank are always slightly rounded, as shown at *C*. Thus, a blank, in going through a series of shaving operations, is sometimes reversed after each operation; that is, the die side that was next to the blanking die is placed next to the punch in the first shaving die and reversed again in the second shaving die.

This alternation or reversing will eliminate the round edges, even though more than one shaving operation is performed. Some engineers prefer to have the pieces shaved in exactly the same manner in which they are blanked—that is, with the die side of the blank on the die side throughout the entire shaving operations.

Another method of eliminating the round edges is to reduce the thickness of the blank by swaging and then pass the blank through a trimming die before starting the shaving operations. Of course, this can only be done with comparatively thick material. Whenever possible, it is always best to

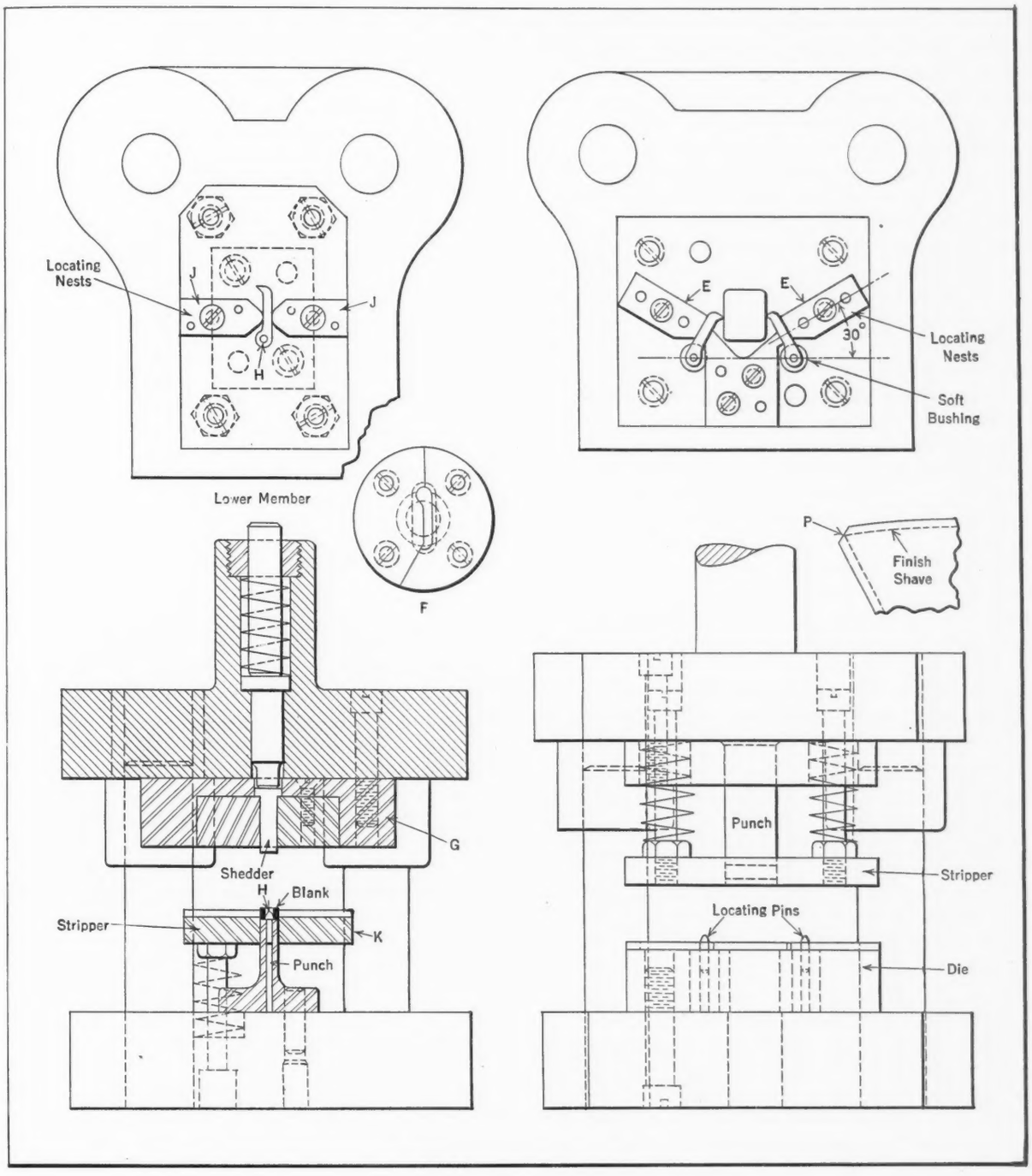


Fig. 2. (Left) First- and Second-operation Contour Shaving Die; (Right) Point Shaving Die Made to Handle Right- and Left-hand Pieces

shave all around the blank. This not only produces a better and smoother blank, but also prevents the blank from creeping as the punch pushes it through the die. Often, however, only certain working points need to be shaved, in which case it is best to shave on the opposite sides simultaneously in order to balance the shaving pressure. Locating of the blanks requires careful attention. Clearance between the stripper and the punch must be provided to permit disposal of the shavings.

Method of Shaving Sharp Points on Blank

When two faces meet at an angle of less than 60 degrees and the material is over 3/32 inch thick, the blanking operation almost always leaves a ragged and torn edge at the intersection of the faces. Shaving operations will not remove the entire fracture, since it is usually very deep and continues to grow during subsequent shaving. Wherever a sharp and clean edge or corner is desired, it must be shaved in a separate operation.

So far we have considered the general principles or essentials that should be observed in designing and constructing shaving dies. Now we will consider the application of these principles to a practical problem. The piece shown at *A*, Fig. 1, is a retaining pawl for a winding ratchet used on a delicate instrument. The thickness is 0.125 (± 0.002) inch. The face is to be smooth, similar to a machine finish, and the working point *P* is to be sharp and its edge parallel to the axis of the 0.136-inch hole. A tolerance of ± 0.002 inch is allowed on all dimensions.

Unquestionably, the best way to produce such an article is by the use of shaving dies. Seven distinct operations are needed to produce the complete article. This may appear to be a large number of operations for so small a piece; nevertheless, it is the most economical method of fabrication. The operations are:

1. Blanking to 0.010–0.012 inch larger than finished size.
2. Swaging or flattening.
3. Rough-shaving swaged part to 0.010–0.012 inch larger than finished size.
4. Drilling and reaming 0.136-inch hole.
5. Shaving point.
6. Shaving to 0.004–0.005 inch larger than finished size.
7. Final shaving to finished size.

Although the finished thickness of the article is 0.125 (± 0.002) inch, it is blanked from 5/32 inch thick half-hard cold-rolled steel to remove the "break" which is so noticeable when blanking heavy material. The blanking die (as shown at the right in Fig. 1) is so constructed that the blank produced is 0.012 inch larger than the finished size. The clearance between the punch and die is 0.002 inch all around; 0.005 inch is the proper clearance, but as the blank is pushed through the blanking die again, a clearance of 0.002 inch is sufficient.

After the blanking operation, the blank is swaged to the required thickness. The blanking die is next equipped with the special nest shown at *D*, Fig. 1. The scrap metal is discharged by moving the slide across the face of the die. The spring moves the slide clear of the punch. The opening in the nest is filed large enough to accommodate the blank after it is flattened. The blank is now pushed through the blanking die again, this time, of course, producing a smoother blank. Drilling and reaming the 0.136-inch hole in a drill jig is the next operation performed.

Point *P* is now shaved to size on the die shown by the two views to the right in Fig. 2, thus leaving no metal on the point to be shaved in the following operations. Only in this manner can the requirements be fulfilled. The amount shaved is controlled by the nests *E* shown in the upper view.

The first and second shaving dies are of the compound type shown to the left in Fig. 2. The blanks are located on the punch by means of the locating pin *H* and the two nests *J* which are attached to the spring stripper *K*. The dies are made in two pieces, as shown at *F*, to facilitate machining and permit grinding after hardening, as well as to produce a smoother finish by honing. The dies are not given any cleavage clearance. A machinery steel ring *G* is shrunk around the die to hold it in place when it is ready to be assembled.

After the first shaving operation, the blank is 0.004 inch over size. In other words, the first shaving die reduces the blank 0.008 inch, or 0.004 inch on a side. The second or final shaving die brings the blank to size.

* * *

Increasing Interest in Air Conditioning

The increasing interest in air conditioning is evidenced by the growth of the home study course in air conditioning maintained by the University Extension Division of Rutgers University, New Brunswick, N. J. Students from thirty-six states and five foreign countries are registered in the home study course in air conditioning. Australia, Russia, France, China, and Canada are the foreign countries represented. The majority of the students in the course are employes of public utility companies, ranging in rank from executives seeking to keep abreast of changing conditions and improvements, to mechanics eager to learn the theory of their craft.

* * *

In the construction of a new automobile road between Munich in Germany and Salzburg in Austria, what is claimed to be the largest reinforced concrete bridge in the world is being built. This bridge, according to the *Uebersee Post*, has a span of 883 feet and is about 76 feet wide.

Necessary Physical Properties of Weld Metal for Machine Building

By E. W. P. SMITH, Consulting Engineer
The Lincoln Electric Co., Cleveland, Ohio

THE desirable physical characteristics of welds vary with the purpose for which the part welded is employed. Thus, in one case, resistance to fatigue may be the most important qualification. In another case, it may be a high yield point. The following is a brief discussion of the physical properties necessary for various purposes.

Wherever there is a reciprocating load, the fatigue resistance of the weld metal is exceedingly important. In the construction of a punch press, shaper, planer, or milling machine the ability of the weld metal to resist fatigue must be taken into consideration. Thirty thousand pounds per square inch, where alternating or varying stresses are encountered, may be obtained with electrodes of the heavily coated shielded-arc types. Laboratory tests of this metal have shown its ability to withstand over ten million reversals with 30,000 pounds per square inch stress in the outside fibers.

Ductility of Weld Must Equal that of Material Welded

Ductility is an important requisite of all weld metal. It is especially important when the parts are subject to deformation. Load stress distribution is governed largely by ductility. In any given structure, the ductility of the weld metal should be at least equal to that of the plate being welded. In the construction of tanks, containers, piping, etc., where the metal is under pressure, ductility is a prime requisite. It is essential, too, in the construction of machinery subject to heavy loads, such as cranes, steam shovels, etc. The ductility should be such as to allow an elongation of 20 to 30 per cent in two inches.

Wherever a slight permanent set in welded parts will lower the efficiency or hamper the operation of the machine, the yield point of the weld metal is important. A crane runway, guides for a machine tool, a frame for a drill press, jigs and fixtures, are examples of parts requiring a high yield point. No matter how high the ultimate strength nor how good the ductility, a low yield point of the weld metal will render the welds almost worthless. A high yield point means that the machine can be operated with a greater load and a greater factor of safety.

Resistance to shock or impact is the determining quality in the design of welds for such parts as steam-shovel dippers, tractor parts, presses, brakes, and similar equipment. Mild rolled steel has a shock resistant value of 40 to 80 foot-pounds (Izod). Welds made with a shielded-arc electrode show a value of 50 to 80 Izod and 35 Charpy—values equal to those of the plate. With bare or washed electrodes, the impact resistance is only 8 to 15 Izod.

Ultimate Tensile Strength

The ultimate tensile strength of the weld metal is important for practically every application where the joint bears any appreciable load. Since shielded-arc electrodes regularly provide a tensile strength of 70,000 to 80,000 pounds per square inch, which is well above that of the plate, the necessary ultimate strength can usually be obtained without difficulty. The ultimate strength should be considered in conjunction with other desirable characteristics. It is evident that two metals—one with high ultimate strength and low yield point, and the other with low ultimate strength and high yield point—will not perform the same, particularly under high load stresses.

Resistance to Corrosion of Weld Should Equal that of Part Welded

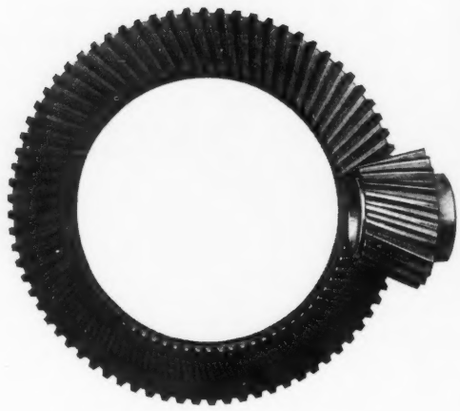
When an arc-welded part is used in proximity to water, steam, acids, or other corrosive agents, the welded joints should have corrosion-resistant qualities at least equal to those of the plate. Such welds are obtainable with a shielded-arc electrode. Tests of welded plate show that after immersion in a 50 per cent hydrochloric acid bath for seventy hours, the shielded-arc weld metal is practically unaffected, while mild steel is badly pitted.

* * *

Goodrich Pension Plan

A retirement pension plan for all classes of workers has been adopted by the B. F. Goodrich Co. and subsidiary companies in the United States and Canada. The employes participate with small weekly payments, and the Goodrich Co. makes the necessary additional contributions. The plan was made effective through the purchase of the largest pension policy ever written by the Aetna Life Insurance Co. Approximately $1,500,000 will be accumulated annually for the payment of pensions.

Industrial Applications of Large Spiral Bevel and Hypoid Gears



Gears of the Spiral Bevel Type Used so Successfully for Automobile Rear Axle Drives are Now Made for Large Power Drives in Sizes up to 90 Inches in Diameter and to Transmit over 1000 H. P.

By E. B. GLEASON, Vice-president
Gleason Works, Rochester, N. Y.

FOR many years the use of spiral bevel gear drives for the rear axles of automobiles has been accepted as good practice. The identification of spiral bevel gears with the automotive field has been so marked that other uses of gears of this type have received comparatively little attention. Nevertheless, curved-tooth spiral bevel gears are being extensively employed in other installations. They have supplanted straight bevel gears in drives that run at high speeds and wherever quietness and smoothness are the deciding factors. The introduction of the hypoid gear in 1925 offered advantages of design and performance to the automotive field. Recently the hypoid has found favor in other fields.

Hypoid Gears Permit the Use of Offset Shafts

The hypoid has the advantage over the spiral bevel gear in that it permits transmission of power between offset shafts. Until the development of the hypoid gear by the Gleason Works, no successful method had been evolved for cutting teeth in tapered gears that were to run on offset shafts. The only gears previously offered for the purpose were the skew gears, which were a form of skew bevel gear and were really nothing more than skew bevel gears whose teeth were cut with different lengthwise inclinations, so that they could run together in an offset position.

These gears have never been satisfactory for drives having offset shafts. In such installations, they have been noisy and inclined to wear rapidly. The reason is obvious. Being generated as bevel gears, the teeth have the profile shape of the teeth of gears which are to run on center; and when the gears are run in an offset position, the teeth will not have the correct profile mesh. In a pair of hypoids, the gear teeth are cut as in the case of a bevel gear; but the pinion teeth are cut in an offset position corresponding to that in which they are to run when in mesh with the mating teeth of the gear. It is by means of this method of pinion-tooth generation that the correct meshing of hypoid gears is obtained.

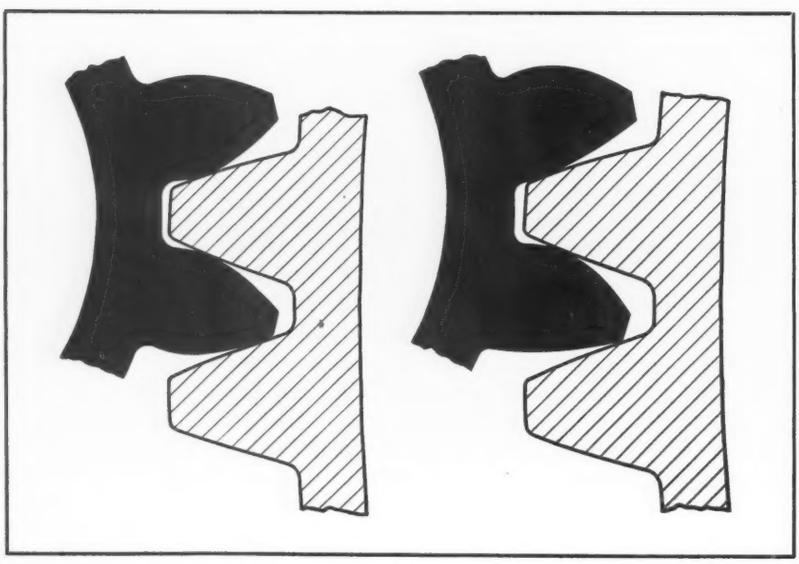


Fig. 1. (Left) Tooth Profiles of Spiral Bevel Gear and Pinion. Fig. 2. (Right) Tooth Profiles of Hypoid Pinion and Gear

A spiral bevel pinion has teeth, the profile of which is symmetrical on opposite sides. Hypoid pinions, when correctly generated, differ from spiral bevel pinions in that the profile of the two sides of the teeth is non-symmetrical. This difference in tooth shape, however, is essential in order to make the tooth action symmetrical on the two sides and to give the desired result of smooth and quiet operation. Figs. 1 and 2 indicate this variation between the two types of teeth.

Characteristics of Large Size Spiral Bevel and Hypoid Gears

All hypoid and spiral bevel gears manufactured by the Gleason Works or cut on machines manufactured by this company are unique in that the teeth are curved lengthwise of the tooth faces. The amount of curvature may be varied to suit changing conditions in the installation, but all gears of this type have this curvature, which permits control over the tooth bearing between the mating teeth and a selection of the bearing that will produce the best results.

For spiral bevel gears over 30 inches in diameter, which are made in great variety and in relatively small quantities, it was necessary to design a type of machine different from that represented by the Gleason No. 16 spiral bevel and hypoid gear generator and the 25-inch spiral bevel gear generator. The No. 16 spiral bevel and hypoid gear generator is shown in Fig. 3. Cutters having diameters of 18 inches are the largest made for this type of machine.

The new type of machine was designed to cut the teeth in gears up to 90 inches in diameter, 1 diametral pitch, and 10-inch face. Within this class of machines there are three sizes: The No. 40 spiral bevel gear planing generator; the 60-inch spiral bevel gear planing generator; and the 90-inch spiral bevel gear planing generator. Fig. 4 shows the 60-inch spiral bevel gear planing generator.

These machines employ a single planing tool which is reciprocated by a crank motion. They are of the continuous indexing type; that is, the tool cuts in a different tooth space during each stroke. The effect of these motions alone would be a tooth of sine-curve form which would not be practical. Accordingly, an oscillating motion of the cutter cradle is introduced. The result is that the teeth are curved longitudinally, and while in a particular case this curvature may be very slight, the gears produced have all the adjustability, tooth overlap, quietness, etc., characteristic of curved-tooth gears.

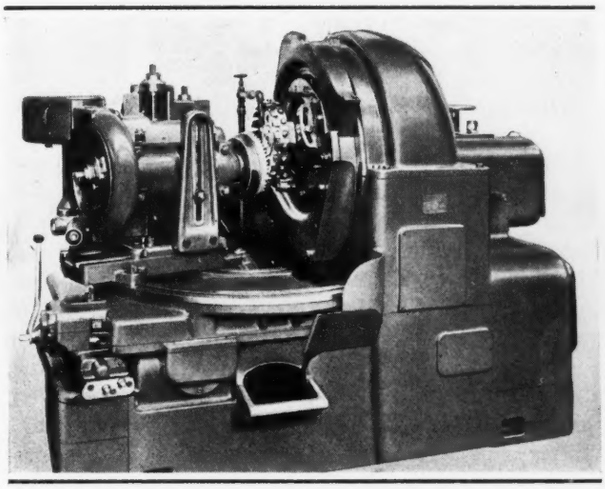


Fig. 3. Gleason No. 16 Spiral Bevel and Hypoid Gear Generator — One of Four Machines Using Multi-blade Cutters

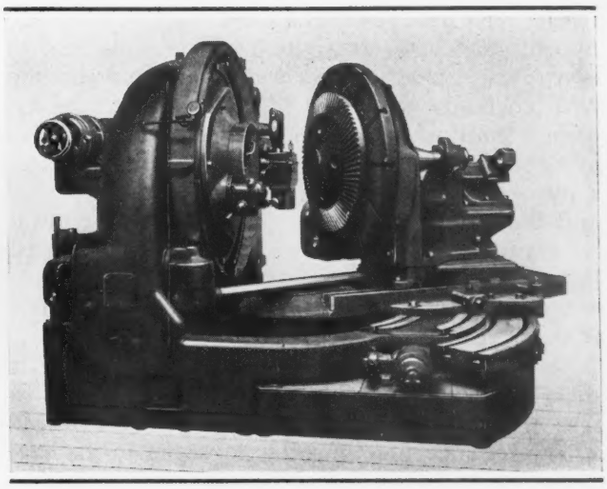


Fig. 4. Gleason 60-inch Spiral Bevel Gear Planing Generator of the Type in which Single Tools are Employed

These developments in gear-cutting machines and in gear design have led to the use of spiral bevel gears in wire and rod mills; paper machinery; newsprint presses; oil-well pumping units; Diesel engines; carpet-weaving machinery; deep-well turbine pumps; pulverizers for stone, cement, and coal; rubber-processing machinery; boring-mill table drives; and plate-glass grinders. It should be mentioned that, in some of these installations, the so-called hypoid type of gearing has been used. An extra work-head which is vertically adjustable is used to support the pinions; this enables the teeth in hypoid combinations to be cut on the same machines as those employed for the spiral bevel combinations.

The term "hypoid" is a coined word derived from the word "hyperboloid." The pitch surfaces of a hypoid pair of gears are not conical but hyperboloidal. Spiral bevels and hypoids have many similar characteristics, and the same general rules ap-

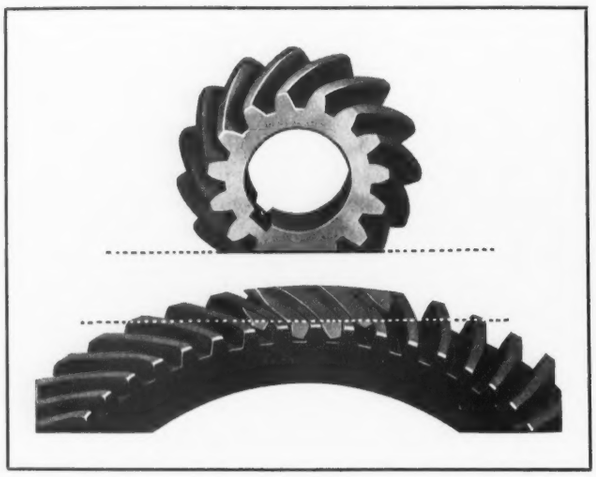


Fig. 5. Spiral Bevel Pinion Removed from Gear, Leaving Section Representing the Contacting Portions of Teeth when the Gear and Pinion are Properly Meshed

ply to their mountings and use. Hence, unless otherwise indicated, the information set down here applies to both types.

The principal advantage of spiral bevel and hypoid gears over straight bevel gears is that the two former, when properly designed and provided with correctly cut teeth and effective mountings, have a continuous pitch-line contact and a larger number of teeth in mesh at any one time. Fig. 5 shows the teeth of a spiral bevel pinion removed and placed in the tooth spaces that they would occupy in the gear if the two were properly in mesh. In the case of hypoids, the area of the teeth in mesh will usually be even greater than in spiral bevel gears.

The teeth of spiral bevel and hypoid gears, instead of striking in full contact at once, as in the case of straight bevel gears, engage with one another gradually and smoothly. Owing to the overlapping action, the load is transferred from tooth to tooth without the shock or sudden change in tooth pressure noted in the case of straight-tooth bevel gears in which such action creates considerable noise and vibration, especially at high speeds. Fig. 6 shows two views of the overlap of spiral bevel and hypoid teeth. The location of the same teeth is marked in both views.

Another advantage of great importance characteristic of the curved-tooth gears cut on Gleason spiral bevel and hypoid generators is that the lengthwise contact of the teeth is heaviest at the center of the face and eases off toward each end of the tooth. The position of the tooth bearing, as well as its length, is controllable and can be made to favor either end of the tooth. This feature allows for some displacement of the gears under operating loads without impairing their running qualities. The same factor provides a range of adjustment in assembly. Fig. 7 indicates the localized bearing between a large spiral bevel gear and pinion.

The advantage of hypoids over spiral bevel gears is that the shafts of both the pinion and the gear can pass each other because of their offset position. The tooth action of hypoids is a combination of the rolling action of straight bevels and the overlapping feature resulting from the spiral angle, together with a small percentage of endwise sliding. A drive using hypoids runs in either direction as easily as one having spiral bevels. The only requirement is that adequate thrust bearings be used in either case.

Strength of Spiral Bevel and Hypoid Gears

The load per tooth in the case of spiral bevel and hypoid gears is less than that for straight bevels, owing to the greater number of teeth in contact. The slight reduction in the sectional area of the teeth is more than compensated for by the inclination of the teeth and the lowering of the point of maximum load application on the profile of the teeth. This results in greater strength for spiral bevels and hypoids than is found in corresponding straight bevels. Accordingly, spiral bevel gears of smaller size than straight bevels are used to transmit the same amount of power.

As an illustration of the use of large spiral bevel gearing, a 48-inch gear of 1.56 diametral pitch, 6 1/2-inch face, and 75 teeth, mating with a 25-tooth pinion, will transmit 1200 horsepower with the pinion running at 1000 revolutions per minute. In this case, both members are of casehardened steel. Hypoid gears are placed on identical wear-load ratings with the corresponding spiral bevel gears, provided they are lubricated by an oil suitable for hypoid service.

Efficiency of Properly Mounted Gears

In actual practice, both spiral bevel and hypoid gears have proved equally as efficient as accurately

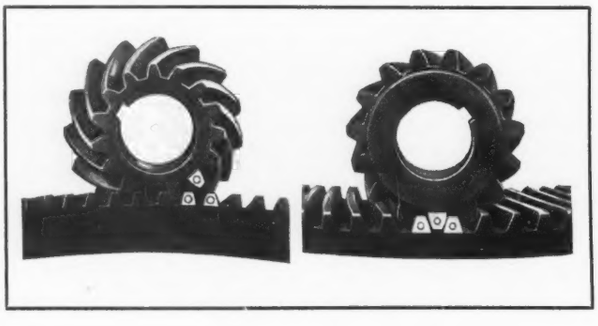


Fig. 6. Views Showing Back and Front of Pinion to Illustrate Extent of Overlap of Spiral Bevel and Hypoid Teeth

generated straight bevel gears, when proper mountings are provided for the radial and thrust loads. In determining the number of teeth to be used, it is well to remember that efficiency and wearing qualities are greater with large numbers of teeth. For ratios of 4 to 1 and over, it is recommended that not less than twelve teeth be used in the pinion, while ten teeth is the practical minimum.

When extreme quietness is not essential, a smaller number of teeth can be used to reduce the size of the installation; but the design, mounting, and manufacture of such gears must naturally be given special consideration. Properly designed mountings and properly manufactured gears, correctly adjusted, should result in an efficiency of over 98 per cent. Laboratory checks have recorded spiral bevel gear efficiencies of over 99 per cent.

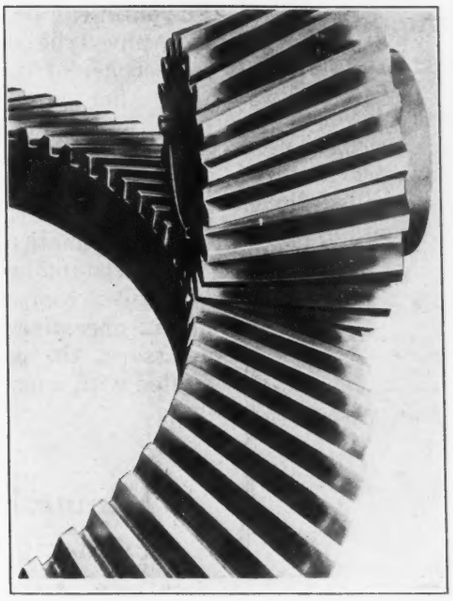


Fig. 7. The Localized Bearing Surface on the Tooth Faces of a Large Spiral Bevel Gear and Pinion are Shown by the Dark or Shaded Areas

Adaptability and Wearing Qualities

Spiral bevel and hypoid gears are adaptable for transmitting power between shafts at practically any angle. They are especially desirable when smooth and quiet gears are required and for large ratios at high speeds, where the size must be kept as small as possible. The continuous pitch-line contact of spiral bevel and hypoid gears makes it practical to obtain superior performance with a smaller number of teeth than is possible with straight bevels. Hypoids are recommended for use in installations with non-intersecting shafts. The offset of the shafts opens up many possibilities. Among the installations in which hypoids have been found to be of great advantage are those in which it is desired to drive several units from one shaft. Fig. 8 is an illustration of this sort of use.

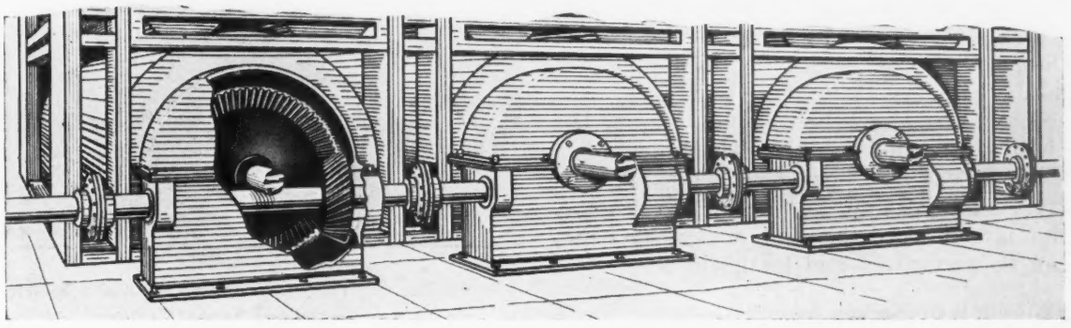
Spiral bevel gears mesh with a rolling contact which is similar to that of straight bevels. If a straight bevel gear were imagined to be cut up into an infinite number of short face sections which were angularly displaced relative to one another, we would obtain a spiral bevel gear. Each section of the gear runs with a pinion section in the same way as a pair of straight bevels.

In a pair of hypoids, a slight sliding action is introduced. This has been found to be an advantage, as it is just sufficient to distribute a lubricating oil film evenly over the teeth. In either spiral bevels or hypoids, as already indicated, there is a continuous pitch-line contact, so that a number of teeth are bearing the load simultaneously and there is a gradual engagement that reduces wear. Under proper conditions of installation and lubrication, the possibilities of wear in either spiral bevels or hypoids are negligible, as compared with other types of gears used for the same purposes.

* * *

At the Century of Progress Exposition in Chicago, the Pennsylvania Railroad has a replica of the famous "first engine," the *John Stevens*. This was built in 1825 by John Stevens of Hoboken, N. J., and was operated for demonstration purposes on a circular track. A gear on the engine meshed with a center rail in the form of a rack. The wheels were not flanged, but were kept on the rails with rather strange contrivances.

Fig. 8. Hypoid Gears Permit the Pinion Shaft to be Offset, so that Several Units can be Driven from One Shaft, as Illustrated



Air-Acetylene Flame for Soldering and Brazing*

The air-acetylene torch, which has a lower flame-temperature than the oxy-acetylene torch, is used advantageously for many kinds of work that require a small, intense and easily controlled flame. The air-acetylene outfit consists essentially of a small tank of dissolved acetylene, of the type used for truck and motorcycle lighting; a pressure regulator which automatically holds the gas at a uniform and correct working pressure; a length of hose made especially for handling acetylene gas under pressure; a torch handle, to which different stems can be attached; and an assortment of stems which make it possible to do very fine, light, medium, and heavy flame soldering. A tip consisting of a soldering iron heated and kept at a constant temperature by the acetylene flame is also provided for soldering copper. With this equipment, a great variety of work can be done.

Typical Applications of Air-Acetylene Flame

Soldering and Brazing
Soldering and Brazing Copper and Brass Tubing and Piping
Sweating Pipe Fittings
Splicing Electric Wires and Cables
Soldering or Brazing Sheet-metal Joints
Fabricating Jewelry
Servicing Air-conditioning Units
Tinning Bearings Prior to Babbitting
Repairing Electric Motors
Heating Operations
Unsoldering Wire, Pipe and Sheet-metal Joints
Melting Gold and Various Other Metals
Drying out Molds
Loosening Frozen Bolts and Other Assembled Parts
Sealing Battery Boxes
Removing Paint and Putty
Branding Stencils in Shipping Room
Lead Burning

The air-acetylene torch is used in a manner similar to the oxy-acetylene torch, but is applied to work requiring a lower flame temperature. While there are some jobs that can be done with either type of flame, a careful consideration of the work will generally show that one method is more economical than the other for a given job. Thus, there is very little, if any, overlapping of the fields of application, the two types serving to supplement each other.

The accompanying table gives some idea of the broad field of application for the air-acetylene torch.

The air-acetylene torch produces a higher flame temperature than gasoline, coal gas, or natural gas. The flame is non-oxidizing and non-carburizing, and it can be accurately and instantly controlled. The outfit can be conveniently used in any position, blow-pipe type stems making it possible to work in a corner or in places that are difficult to reach with other types of equipment. The small but intense flame can be focussed or directed exactly where it is needed. Each stem contains an individual mixer which serves to proportion correctly the acetylene and air, so that the proper flame is maintained automatically.

An outstanding advantage of this type of outfit is that it is completely portable, and can be quickly put in operation. No preheating of the stem is necessary, the gas simply being turned on and lighted with a match or friction lighter.

*Abstract of article in *Oxy-Acetylene Tips*.

* * *

Minute Parts Produced in a Seven-Eighths Inch Automatic

A considerable work range is of great importance when an automatic screw machine is to be used for producing a variety of parts over a period of time. Offhand, it would not be supposed that a 7/8-inch automatic would be suitable for making the tiny electrical contact parts shown in Fig. 1. Yet parts of this size have been produced in a 7/8-inch Gridley automatic, built and tooled up by the National Acme Co., Cleveland, Ohio.

The dimensions of this part are given in the bottom sketch of Fig. 2. It is made from No. 1112 S A E screw stock, and the production is 260 pieces an hour, or one piece every 14 seconds. The machine itself is capable of a faster rate of operation, but when it was speeded up, the parts broke off the bar stock before they were completed.

Fig. 2 shows the sequence of operations performed by the screw machine. At the lower rear station of the spindle carrier, the bar stock is faced

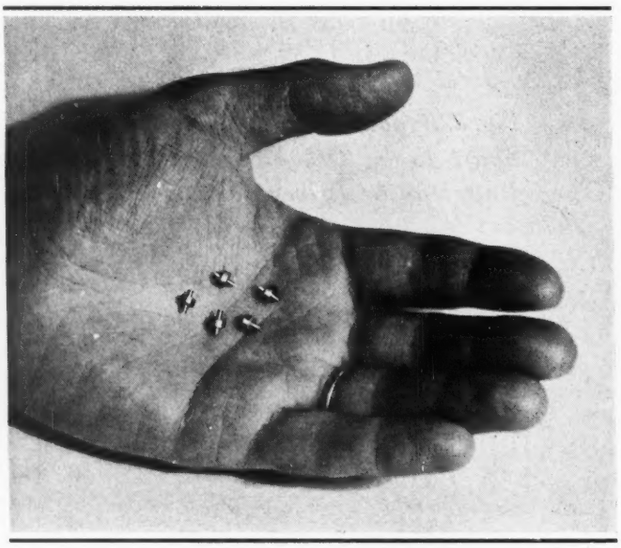


Fig. 1. Tiny Parts Produced in a 7/8-inch Automatic Screw Machine

by a tool on the main slide while a forming tool on the lower rear cross-slide starts reducing the diameter of the front end of the part. When the work has been indexed to the lower front station of the spindle carrier, a tool on the lower front slide finish-forms the front end to a diameter of 0.057 inch.

At the upper front station of the spindle carrier, the back end of the part is turned to a diameter of 1/16 inch by a forming tool on the front top slide. The operation is completed when the part is cut from the bar stock at the upper rear station of the spindle carrier by a tool held in the rear top slide.

* * *

Industrial Conditions in Czechoslovakia

Another indication of the general improvement in industrial conditions in many parts of Europe is found in a report made by S. E. Woods, commercial attaché of the Department of Commerce, at Prague, Czechoslovakia. Mr. Woods states that there has been an improvement in the machinery market in that country which started at the end of February and continued steadily up to the middle of May, when his report was written. The machinery sold was mainly for agricultural purposes, registering an increase of 30 per cent over the sales a year ago. The prospects for machine tools and metal-working machinery in general are not quite so bright, due to the fact that the Czechoslovakian metal-working industry was well equipped with new machines five years ago. The industry has been working at only 30 per cent of capacity during the last two years, and hence there has been only a limited need for replacements of machinery.

* * *

The highest self-supporting tower in the United States used as an aerial has recently been built by the General Electric Co. at Denver, Colo. The tower is 470 feet high and is 35 feet square at the base, tapering to a 2-foot square at the top. It is built to withstand a wind velocity of 125 miles an hour.

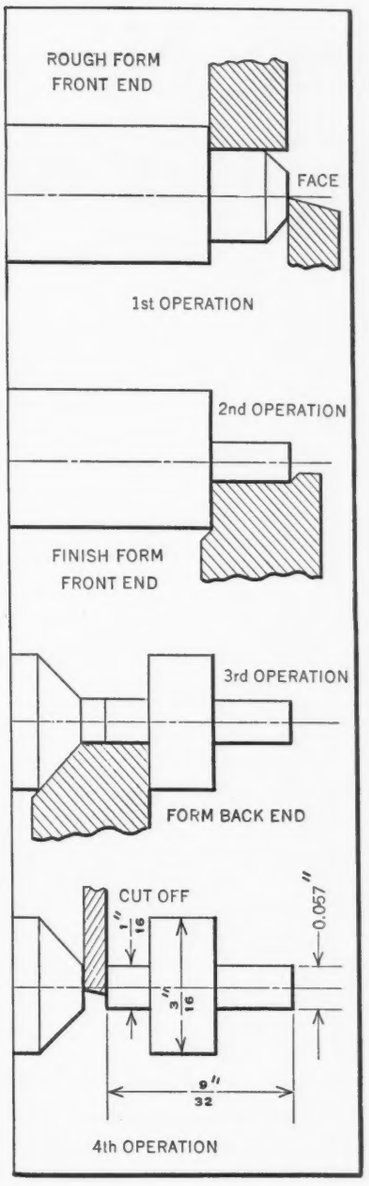


Fig. 2. Sequence of Screw Machine Operations in Making Parts Seen in Fig. 1

Fiftieth Anniversary of the Whiting Corporation

This year marks the fiftieth anniversary of the Whiting Corporation, Harvey, Ill., manufacturer of cranes, foundry equipment, and railway specialties. John Hill Whiting, the founder, is still active as chairman of the board. Mr. Whiting began his business career in Detroit as a clerk in a car-wheel foundry. While so employed, he spent his spare time in acquiring a practical knowledge of the foundry business and soon became superintendent of the foundry. He developed a number of improvements in cupola construction, on which he secured patents and launched a new business known first as the Detroit Foundry Equipment Co.

In 1894, the first part of the present plant was built at Harvey, Ill., where the business was conducted under the name of the Whiting Foundry Equipment Co., which was later changed to the Whiting Corporation. It is of interest to note that the first successful gasoline motor truck for commercial use was designed and built in the Whiting plant as far back as 1904.

* * *

Although the present tendency in almost every country, and especially in Germany, is to prefer products of domestic manufacture, including machine tools, there would be an increasing demand for American machine tools in Germany at the present time, according to reliable information received from abroad, if it were not for the restrictions imposed by the German government on the transferring of money out of the country. As a result, the amount of money available to pay for shipments of American machine tools has been greatly reduced.

As a rule, importers are permitted to buy a specified percentage of the amount imported during the last six months of 1930 and the first six months of 1931. The quota at present is 25 per cent; and since the period specified was a critical one for machine tools, the quota is very small. Until recently, permits were granted for special machinery, but now, an investigation is made in each case to see if domestic machines could be used instead.

Engineering News Flashes

The World Over

Shipping Hydro-Electric Station by Air

The shipping of the entire equipment of a hydro-electric generating station to the point of operation by air is certainly an unusual undertaking. Four General Electric horizontal water-wheel generators rated at 875 K.V.A. each, together with auxiliary apparatus, were shipped by steamer to Lae on the coast of New Guinea. From there the machinery was transferred, one section at a time, to huge all-metal Junkers freight planes and flown 40 miles inland to the location of a power plant operated in connection with a gold-mining enterprise.

While the distance traversed was only 40 miles, it presented almost insurmountable obstacles to other forms of transportation, including, in addition to a dense, nearly impassable jungle, a mountain range whose peaks rise to 13,000 feet. The planes were capable of carrying loads up to 7000 pounds, and the equipment was delivered piece by piece and was then assembled in place. The largest single pieces were the generator stators which had a net weight of 6545 pounds each.

Metal Wire Finer than Human Hair

The Prescot Works of the British Insulated Cables, Ltd., is manufacturing metal wire 0.002 inch in diameter, which is considerably less than the average diameter of human hair. This wire is used for electrical purposes and is coated with electrical insulation enamel, five coats of which have a radial thickness of only 0.0002 inch. A one-pound coil of this wire has a length of 15.5 miles.

Balls Instead of Wheels on Soviet Train

A Russian engineer has constructed a new type of train, a model of which is undergoing tests on a special track. Ball-shaped members of large size are substituted for the wheels. The train, instead of running on a track of the ordinary type, runs in a concrete trough of semicircular cross-section. A huge steel ball at the end of each car rolls in the trough. Higher speeds, with safety, are claimed for the new design. Problems encountered when trains travel on rails at a speed of over seventy-five miles an hour are said to be overcome and the danger in rounding curves at high speeds is eliminated. The inventor claims that experiments indicate that cars of his design can safely round curves at two hundred miles an hour. It will be interesting to see whether this idea can be translated into practicability. In any event, the originality of the inventor is worthy of commendation.

New Type of Shatter-Proof Glass

What is known as "toughened" glass, introduced on the British market last year, is being made by the Triplex Safety Glass Co., Ltd., Birmingham, England. This glass possesses extraordinary strength, as evidenced by the fact that in recent tests a steel ball which smashed ordinary glass when dropped from a height of only 9 inches had to be released from a height of 156 inches before it shattered a pane of toughened glass of the same thickness. This glass consists of a single thickness and is not of the laminated type used as safety glass in the past. When broken, it does not fly like ordinary glass, but merely crumbles into blunt-edged, sugar-like crystals.

Roller Bearings on High-Speed Trains

One of the important features of the new streamline Burlington train is the fact that Timken roller bearings are used on all axle journal boxes. The use of anti-friction bearings throughout this train makes an important contribution to the attainable speed and the ease of riding, in addition to the lower maintenance and operating cost effected. Operation at the high speed of which this train is capable, naturally demands a type of bearing in the wheels, especially in rounding curves, with an inherent ability to carry thrust loads that come from the side. The tapered construction of these bearings enables them to carry all types of loads, both from the side and up and down.

A Huge Drawing-Board

The world's biggest drawing-board—as large as a ballroom floor—is being used by the Patterson-Leitch Co. in the construction of the observatory which will house the world's second biggest telescope, now being built by the Warner & Swasey Co., Cleveland, Ohio. Circular in form, the steel

members that go into the construction of the observatory must fit within a fraction of an inch. As a result, after the drawings are made, they are transferred full-size to the room-like drawing-board. Then wooden templets are made that correspond accurately with the steel members themselves. In no other way, it is stated, would it be possible to be sure of getting the exact curves required in the girders.

Air Conditioning in Manufacturing

The Westinghouse Electric & Mfg. Co., at its East Pittsburgh plant, is assembling and sealing the air conditioners manufactured by the company in a huge air-conditioned enclosure, where modern equipment keeps the room free from dust and maintains a uniform temperature. The assembly of equipment like air conditioners in an air-conditioned manufacturing department is believed to be an innovation in manufacturing practice, and is expected to materially improve the quality of the units built, because of the clean and uniform atmosphere in which the work is carried on.

Autogiros Now a Commercial Product

The firm of A. V. Roe & Co., Manchester, England, having acquired from the Cierva Autogiro Co. the sole British rights for the manufacture and sale of the autogiro type of airplane, is now manufacturing these planes on a considerable scale. The present model is a two-seater, open-cockpit type, but later larger planes will be manufactured. These autogiros are capable of landing in a space no bigger than a tennis court and can rise and descend almost vertically. They are capable of any speed from 15 to 100 miles an hour.

Automobiles without Chassis

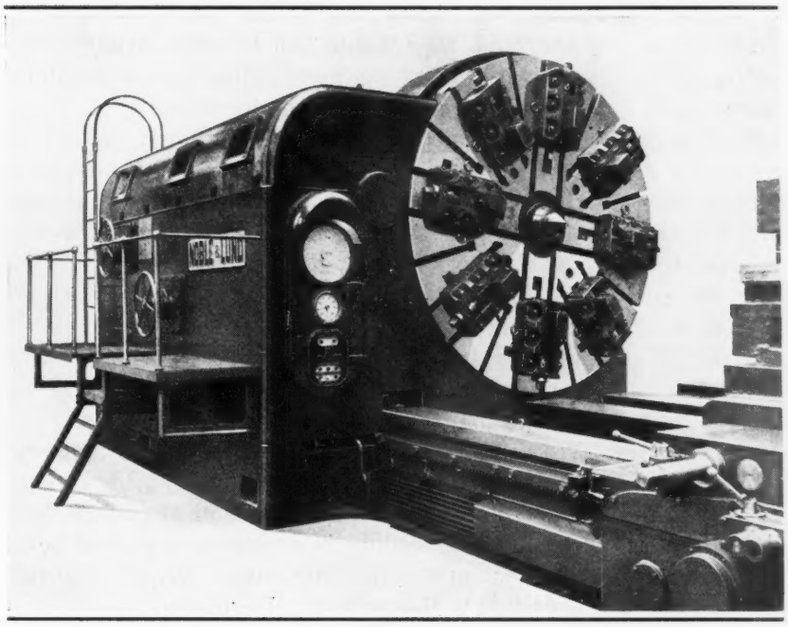
The well-known Citroen Automobile Mfg. Co. in France is said to be planning to place on the market a small 7-horsepower automobile having many novel features, the most outstanding of which is that there will be no chassis proper, but the body of the car will form the chassis. The spring suspension in its usual form will be dispensed with, and instead the suspension will be taken care of by an arrangement of torsion bars. The Citroen company is also said to be developing a car with a motor placed in the rear.

A Gasoline Engine Refrigerator

In country districts where there is no electric current, it is obvious that the electric refrigerator cannot be used. The Waukesha Motor Co., Waukesha, Wis., has therefore developed a refrigerator the power problem of which is taken care of by an internal combustion engine, contained in the regular refrigerator cabinet. Since gasoline is available everywhere, this refrigerator has a wide application. It can even be carried along to summer camps in outlying districts.

A Novel Blown-Fuse Indicator

A fuse provided with a miniature Neon lamp indicator has been developed by the L. S. Brach Mfg. Corporation, Newark, N. J. When a fuse blows, the little Neon lamp glows, indicating which one of a number of fuses is blown. When a new fuse is put in, the light goes out. The new device is known as the Fuse-O-Lite indicating cutout and is interchangeable with present lines of plug and cartridge cutouts.



Lathe Built by Noble & Lund, Ltd., Felling-on-Tyne (Referred to in July MACHINERY, Page 657), Believed to be the Most Powerful Lathe Ever Built in Great Britain, and Designed for Machining Castings and Forgings Weighing up to 150 Tons. It can Take Work 60 Feet Long between the Centers and can Swing Work up to 9 Feet 2 Inches in Diameter over the Ways. It is Driven by a 250-horsepower Variable-speed Motor. The Weight of the Machine is 270 Tons.

EDITORIAL COMMENT

Real recovery depends on the activity of industrial enterprise, stimulated by the investment of private capital. If capital is encouraged to invest, employment will increase, the consumption of goods will be accelerated, and business will become progressively better. If capital is discouraged from taking the initiative, the reverse will happen, and business will become progressively worse.

Confidence is Needed to Insure Industrial Recovery

Short of state capitalism, there is no substitute for private capital that can be employed for putting into motion the train of recovery operations. Private capital cannot be forced to invest in industry; but it can be encouraged. And the encouragement must come from the Administration.

Confidence-begetting moves on the part of the Administration will encourage capital and industry to go ahead; confidence-destroying acts will make business increasingly timid. Employment can be temporarily increased by emergency measures, but the continued appropriation of public funds to create jobs can at best only postpone, and in the end will almost certainly aggravate, the trouble. Whether we like it or not, these are the facts, and these facts must be faced.

We believe that the Administration can do much to stimulate the return of confidence and of industrial activity. To be specific, there are three things that are essential:

1. A positive, straight-from-the-shoulder statement by the President that the profit motive in industry is neither to be upset nor tinkered with. There has been so much loose talk by both friends and enemies of the Administration that such a statement is essential. Inferences are not enough. The very fact that the issue has not been squarely met encourages rumors and undermines confidence.

A Reassured Industry Would Go Ahead with New Projects

2. An allaying of the fear that the Government is aiming at Administrative control of business. Business men are genuinely afraid of increasing control, whereby sooner or later politics will supplant business efficiency. That this is not the intent of the Administration has been stated, but it needs to be reaffirmed, because the action of some government officials has not been in harmony with the official statements.

3. A definite statement of the Administration's monetary policy. The fear of uncontrolled inflation is lurking in the back of the mind of every thoughtful business executive. If the Administration has a sound plan for preventing the monetary system from getting out of control, the country needs to know what that plan is. The lack of information pertaining to a recognized program encourages the belief that the Administration has no definite monetary policy and is simply drifting with the tide.

To create confidence is the supreme problem of the Administration at the moment. Action on these three points would go far toward accomplishing this result. With returning confidence would come complete recovery.

Recently we heard a professor of machine design object to the use of engineering handbooks by his students. He said that since the handbooks give formulas without showing their derivation, the student makes use of the formula without obtaining any knowledge as to the engineering method by which it is derived. Fortunately, most teachers of engineering do not share this opinion; if they did, they would fail to acquaint their students with one of the most valuable tools available to engineering practice—the handbook.

Engineering Handbooks are among the Engineer's Most Valuable Tools

There is no reason why a student cannot be taught how to derive formulas for himself by a strict engineering procedure, and at the same time be shown how to make the most advantageous use of handbooks. One of the principal objects of all education is to give the student a capacity for further study—ability to make use of the accumulated knowledge in his particular field. Nowhere is this accumulated knowledge of engineering more readily available than in engineering handbooks.

We cannot refrain, in this connection, from repeating a story told us some time ago by an educator. In answer to a test question, "State the best preliminary procedure in designing a pair of bevel gears," one of the students simply wrote: "Consult MACHINERY'S HANDBOOK." He passed.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Mechanism for Operating Magazine Feed-Slide

By J. E. FENNO

Electrical knife switches are automatically assembled on their slate bases in a machine equipped with a magazine that feeds the bases to a dial by means of a pusher-slide. An interesting feature of this magazine is that, although the stroke of the feed-slide is only 4 3/4 inches, this slide serves to transfer the base over a distance of 7 1/2 inches. Referring to the illustration, the magazine is shown at *A* fastened to the machine frame *B*. The feed-slide is indicated at *D*. It rests on the top of the machine and operates between guide *E* and guide *F* which is an extension of the magazine. The slide is reciprocated by the oscillating lever *G* through the link *H* and the stop *J*, stop *J* being attached to the slide by the pivot pin *K*.

The lever *G* is shown in its farthest position to the right, where it has carried the base *L* out of the magazine. As the lever and slide move toward their left-hand position, base *L* is carried against the counterweighted pawl *M*, pivoted to the block *N* which is secured to the magazine. Continued movement of the lever toward the left causes the pawl to push the base off the slide, so that when the latter has reached its extreme left-hand position, the base drops on top of the machine frame *B* between the guides *E* and *F*.

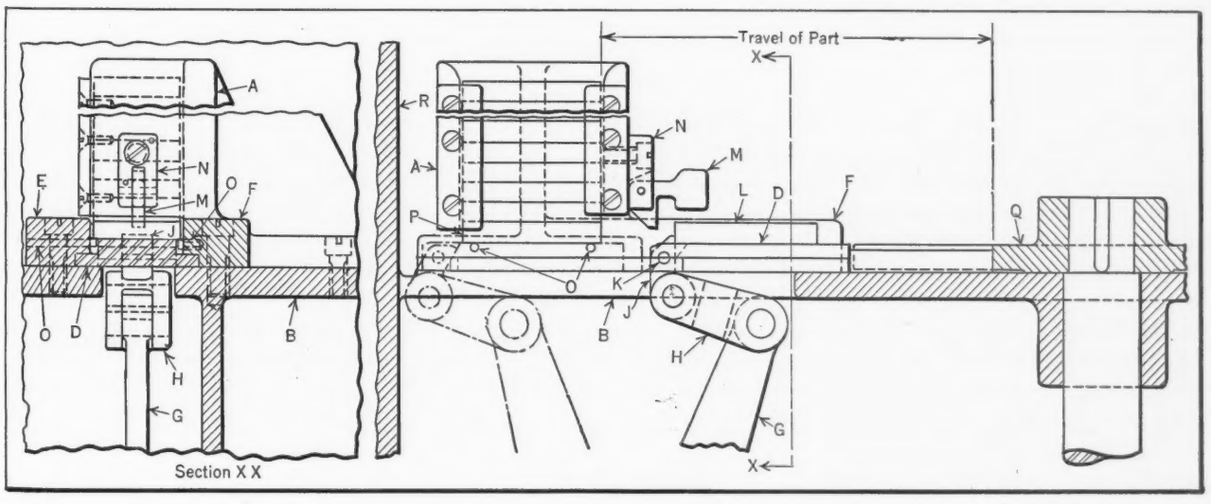
Since the bottom base in the stack rests on the pins *O*, the stop *J* must clear the bottom base as the slide returns to its left-hand position. This is accomplished by the link *H*. Obviously, as the lever swings toward the left, the stop will swing in a clockwise direction, so that its protruding point recedes below the top of the slide. The stop remains in this position until the lever and slide are at the left-hand end of their stroke, as indicated by the dot-and-dash outline.

When the lever moves toward the right, the dog automatically swings back to its former position and pushes base *P* out of the magazine. In the meantime, base *L*, resting on the machine, is pushed by the front end of the slide into a slot in the dial *Q*. An added advantage of this mechanism is that it can be used effectively where space at the left of the magazine is limited (see side view), as it is in this case by the machine wall *R*. Ordinarily, a long slide would have been used which would have required considerable clearance at this point.

Rapid Advance Mechanism for Conveyor

By F. H. MAYOH

In a production line where a chain conveyor is used, it is sometimes necessary to lift the article conveyed clear of the lugs on the chain while the chain is in continuous motion.



Mechanism that Feeds Knife Switch Bases from Magazine A to Slots in the Dial Q

The mechanism shown in Fig. 1 was developed to meet a requirement of this kind. The article conveyed in this case is required to be rapidly advanced ahead of the chain travel at the last station and brought into position where it can be elevated by an auxiliary mechanism before it is overtaken by the chain lugs. The two views at the left, Fig. 1, show the general construction of the mechanism, while the two views at the right illustrate the manner in which it functions. The sectional view, Fig. 2, shows the details of a tension drag employed on the lever *R*.

In the side view, Fig. 1, the articles conveyed are indicated at *A* and *B*. There is a pair of chain conveyors at *C*, which travel in the direction indicated by the arrow *D*. The arm *E* is in contact with the work and has advanced it ahead of the position it would normally have reached as a result of the conveyor movement. The mechanism is shown at the completion of the advance movement. This mechanism has a grooved cam *F* which revolves with shaft *G*. Over the block *H* is assembled a yoke *J*, which carries a roll *K* that rotates in the cam groove, causing yoke *J* to oscillate horizontally.

This action, through the medium of rod *L*, causes lever *M* to rock shaft *N* back and forth. A similar movement is imparted to a pair of levers *P* which, in turn, transmit a longitudinal reciprocating movement to a pair of rods *Q*. Rods *Q* transmit a rocking and transverse movement to the unit consisting of arms *E* and levers *R*, which results in advancing the work *A* and *B* and returning the unit to its starting point.

The side view shows the work *B* fully advanced, while the lower view at the right shows the position of the various members during the first portion of the return movement of arm *E*, as rod *Q* advances in the direction indicated by arrow *S*. This movement causes arm *E* to pivot about stud *T* as a center until lug *U* comes in contact with the side of the lever. It will be noted that, during the advance movement, the lug *V* was in contact with the other side of lever *R*.

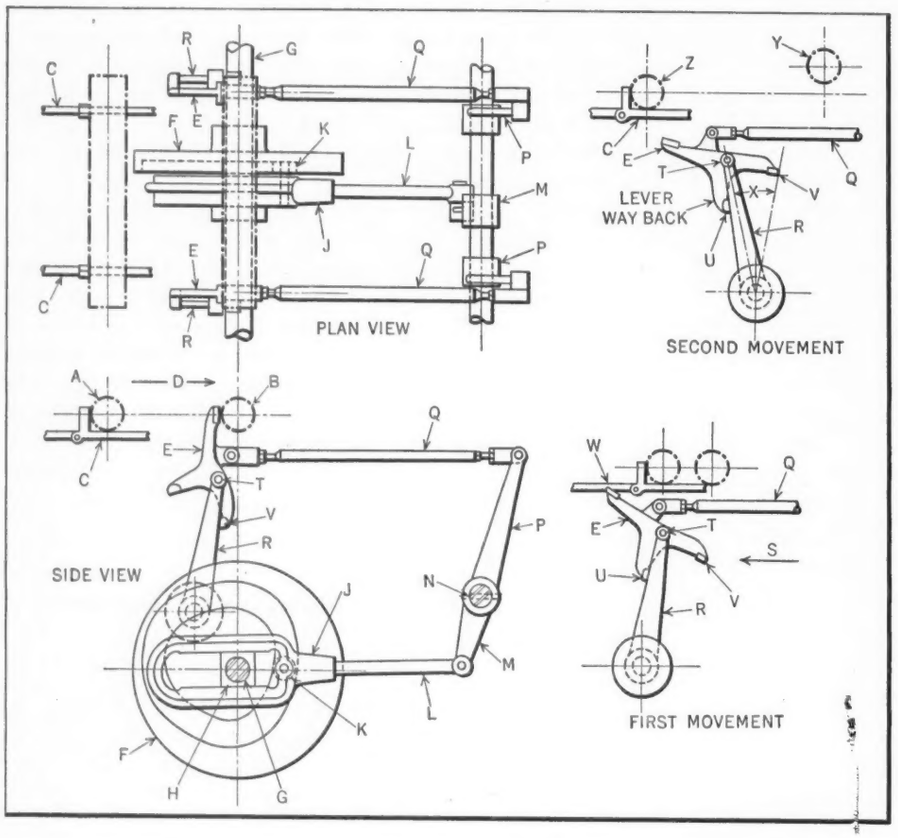


Fig. 1. Mechanism for Raising Work from Chain Conveyor and Advancing it to Operating Position

When the lug *U* is in the position shown in the view in the lower right-hand corner, the top of arm *E* is below the level of the work, as indicated at *W*, although lever *R* has not yet been moved. Continued movement of rod *Q* in the direction indicated by arrow *S* causes lever *R* to be pushed to the left until the entire mechanism assumes the position indicated in the upper view, where lug *U* is still in contact with the lever and the arc of travel is indicated by *X*.

Another article has now been brought forward, as shown at *Z*, and the position of arm *E* is such that rod *Q*, in pulling arm *E* to the right, will cause it to pivot about stud *T* until it swings behind the work *Z*, when lug *V* will be in contact with lever *R*.

Continued movement of rod *Q* will cause the article at *Z* to be rapidly advanced ahead of the chain travel, so that another mechanism—not shown—can pick up the work and raise it clear of the chain lugs into the position indicated at *Y*.

To insure that arm *E* will pivot about stud *T* during the first movement of the advance action and the first movement of the return action without imparting any movement to lever *R*, the latter lever is constructed as illustrated in Fig. 2. Lever *R* is shown as pivoting on the short shaft *A*, which is pinned at *B* to the side frame *C* of the machine. Two lock-nuts *D* permit the tension exerted by the spring *E* against the lever to be so adjusted that its movement is retarded until there is a definite

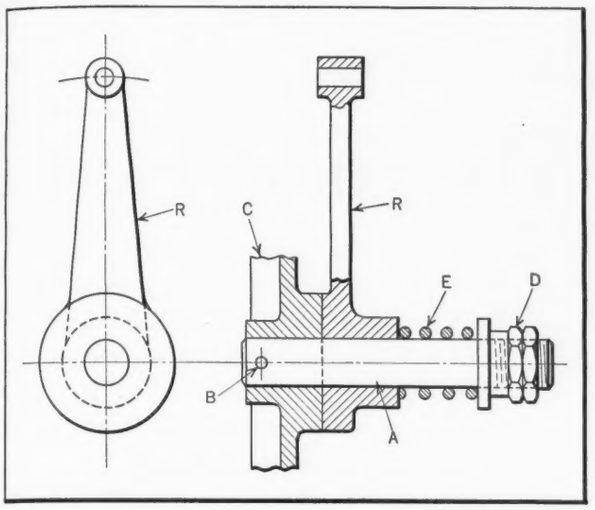


Fig. 2. Details of Friction Drag Applied to Lever R, Fig. 1

pull in either direction that is sufficient to assure the correct functioning of the mechanism.

The action of this entire unit may be summarized as follows: As the chain conveyor carrying the work travels along, arm *E*, Fig. 1, swings up and in back of the work, rapidly advancing it throughout its forward motion. After the work has been lifted clear, the arm swings in back of the next article.

Variable Ratchet Motion Mechanism

By L. KASPER

A ratchet mechanism that automatically increases and decreases the movement of the driven shaft twice in each revolution is shown in the accompanying illustration. This motion is applied to a wire-forming machine to produce a constantly varying rate of feed. The gear *B* and the ratchet wheel *C* are mounted on shaft *A* and revolve with it. The oscillating lever *D* is free on shaft *A* and carries the pinion *E*, which meshes with gear *B*. Lever *D* also carries the pawl *J*, which engages ratchet *C*.

Lever *F* is attached to the side of pinion *E*, and is connected to the link *G* at its lower end. The upper end of link *G* is carried on stud *K*, which also carries one end of the rod *H*. Stud *K* fits into a hole in the block *M*, which slides in a dovetail groove on the upper end of lever *D*.

In operation, rod *H* is given a reciprocating motion by a cam. The movement of rod *H* produces an oscillating motion of lever *D* on shaft *A*. On the forward stroke, pawl *J* engages with ratchet *C*, causing the entire assembly to make a partial revolution in the direction indicated by the arrow on gear *B*. On the return stroke, pawl *J* rides over the teeth of ratchet *C*, while shaft *A*, with gear *B*, remains stationary. This causes pinion *E*, which meshes with gear *B*, to make a partial revolution.

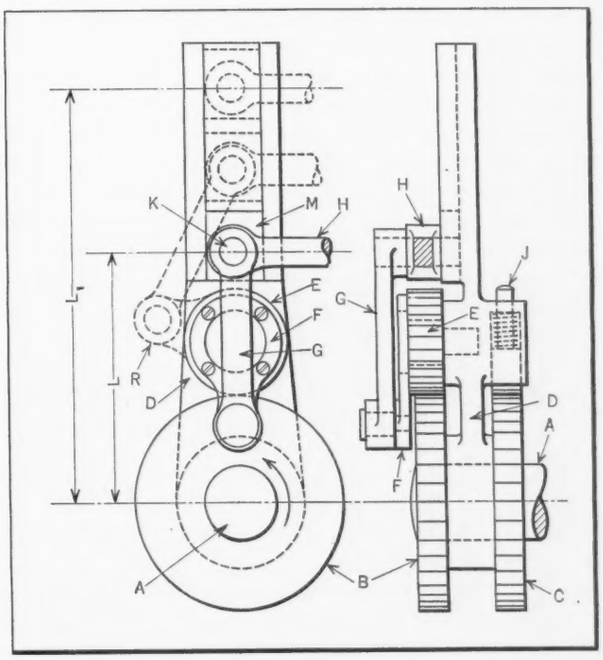
The movement of pinion *E* carries lever *F* to the position indicated by the dotted lines *R*, causing the link *G*, connected to rod *H* by stud *K*, to move upward, increasing the center distance between stud *K* and shaft *A*. In this manner, the length of the lever arm is varied from *L* as a minimum to L_1 as a maximum. The number of cycles performed per revolution of shaft *A* is determined by the ratio between gear *B* and pinion *E*, which, in this case is 2 to 1.

* * *

Saw Blades Protected with Aluminum Paint

As a rust preventive finish for saw blades, aluminum paint has been found unusually effective, according to the Henry G. Thompson & Son Co., of New Haven, Conn. The paint is applied over the entire surface of high-speed steel hacksaw blades by means of a spray gun. In the past, it has been customary to sandblast high-speed steel blades to distinguish them from the ordinary tungsten alloy blades. Although this improved their appearance, it did not prevent them from tarnishing and rusting.

Aluminum paint was adopted by the Thompson company after exhaustive tests had been carried on with a variety of rust preventives and preservatives. It was found that, in addition to enhancing the appearance of the blades and protecting them from rust, the coating of aluminum paint acted as a lubricant for the saw, making cutting easier, particularly with hand hacksaw blades. The side wear on the blades was also reduced.



Ratchet Mechanism that Automatically Increases and Decreases Effective Length of Ratchet Arm Twice During Each Revolution

Tools and Methods Used in Machining Fiber

Although Practically All Types of Machine Tools Used in Machining Metal are Employed in Fabricating Fiber Products, Certain Modifications in Their Applications are Necessary for Best Results

THE light weight, strength, and insulating properties of fiber make this material well adapted for many purposes. It is obtainable in three basic forms—namely, sheets, rods, and tubes. From these three forms are machined countless numbers of parts, ranging from small washers to accurately machined gears or pinions. The methods here described represent the practice recommended by the Spaulding Fibre Co., Inc., Tonawanda, N. Y., for machining Spaulding hard fiber and Spauldite.

Hard Tools and High Speeds Used for Fiber

The hardest tools, such as Carboloy, high-speed steel, highly tempered saws, etc., should be used in machining both these materials. In general, tools should be run at relatively high speeds, taking heavy cuts. All tools should be sharpened with little or no rake and ample clearance.

Sheets of hard vulcanized fiber up to 1/4 inch in thickness can be cut up into strips with power-operated drop-knife shears or with a power-operated rotary slitter. Drop-knife paper cutters can be used for cutting sheets 1/32 inch thick in 2-inch pile-ups. Hand-operated drop-knife shears can be used for cutting sheets 1/16 inch in thickness.

Both the punching grades of Spauldite up to 1/16 inch in thickness and the fabric base grades up to 3/32 inch in thickness can be sheared on a drop-knife shear without heating, but better edges are insured if the material is heated to approximately 200 degrees F. Both hard fiber and Spauldite can be sawed on wood-working machinery. For rough cuts, band saws from 1/4 inch to 2 inches in width are used, according to the thickness of the stock and the nature of the work. The saw should be run at approximately 4000 lineal feet per minute. The teeth should be ground straight across to insure straight cutting.

Using Circular Saw to Obtain Smooth Finish and Accuracy

When smooth edges or accurate dimensions are required on tubing or sheets, a hollow-ground circular saw, 14 inches in diameter with 120 teeth, is recommended for stock up to 1/4 inch thick. A saw with 80 teeth is recommended for stock over 1/4 inch thick. The saws should be run at approximately 3000 revolutions per minute. They should be hollow-ground, 10-13-10 gage, and tempered hard. These saws should be sharpened every thirty to fifty minutes, without set, with very little front rake, and with a liberal amount of clearance, bringing each tooth to a sharp point.

In most cases, holes with fairly smooth edges can be punched in hard vulcanized fiber up to 1/4 inch thick by rough-punching with dies similar to those used on metal.

Finishing Rough-Cut Pieces in Shaving Dies

When smooth edges are required, shaving dies are used on the rough-punched or sawed blocks. A cutting edge at an angle of 45 degrees to the work shaves off from 1/16 to 1/8 inch of stock. As the die has no clearance for a distance of 1/4 inch back from its face, it can be ground without changing the size. Stock up to 1 1/4 inches thick can be smooth-punched and given a clean smooth edge by successive shaving operations.

For rough-punching Spauldite, less clearance is required between the punch and dies than for metal. No shear should be given either the punch or die. If the proper grade of Spauldite is selected, it can be punched in thicknesses up to 3/32 inch without hold-down plates or pressure pads. The hole will be 0.002 to 0.005 inch smaller than the punch diameter, and the outside of the blanked piece will be from 0.002 to 0.005 inch larger than the die diameter.

Spauldite can be smooth-punched by forcing blocks through a shaving die, allowing 1/16 to 1/8 inch of stock all around for shaving. Any tendency of this material to break or crack while being punched can be overcome by heating to 230 degrees F. in an oven or on a hot plate.

Fiber and Spauldite parts can be machined in an ordinary lathe or screw machine from rod or tubular stock. The tools employed should be of Carboloy or high-speed steel, ground without any rake but with a clearance of from 30 to 60 degrees. A cutting speed of from 300 to 500 feet per minute is recommended. The coarsest feed commensurate with the desired finish should be employed, and the tools should be kept sharp.

For drilling either fiber or Spauldite, high-speed drills or special drills with a large spiral angle, narrow web, and wide flutes, such as are used for Bakelite, are recommended. These drills should be ground with a liberal clearance and should be run at the highest practical speed.

Both solid and self-opening dies are used for threading hard vulcanized fiber and Spauldite. Smoother threads are obtained if the dies are given a negative rake of about 7 degrees, and the cutting edge dulled slightly with a V-shape stone.

In tapping these materials, the tap holes should be made from 0.003 to 0.006 inch larger than when tapping brass or steel. Allowance should be made for the fact that the drill cuts a hole a few thousandths inch smaller than the drill diameter.

Washers, right-angle pieces, etc., can be formed by punch press dies from thin hard fiber of the proper grade. Heated dies are usually employed for this work. The fiber bends best parallel with the grain, which runs lengthwise of the sheet. It can also be creased in properly designed dies to permit folding in the assembly operations without fracturing the fiber.

Welding Steel Barrel Liners at the Rate of Thirty an Hour

By GEORGE H. HALL

The demand for stainless-steel liners for beverage containers led to the development of the interesting welding process described here. The barrel itself consists of two cylinders, the outer of which is made from standard steel and is separated from the inner one by an air space to insure proper insulation. The inner case is made of stainless steel, and is built up of two thimbles which are welded together on a General Electric seam welder equipped as shown in Fig. 1.

In drawing the thimbles, their edges are accurately formed, so that they can be butted together to form a true joint. For the actual welding of the two parts, a thimble is placed in each of the clamping chucks, as shown in Fig. 1. Each of the chucks has six jaws, which are operated by oil pressure. The sliding tail-piece with one of the thimbles clamped in place is fed up to the head of the machine and the two halves of the lining are brought into tight contact, as shown in Fig. 2, after which the welding proceeds.

The welding itself is done by the atomic-hydrogen

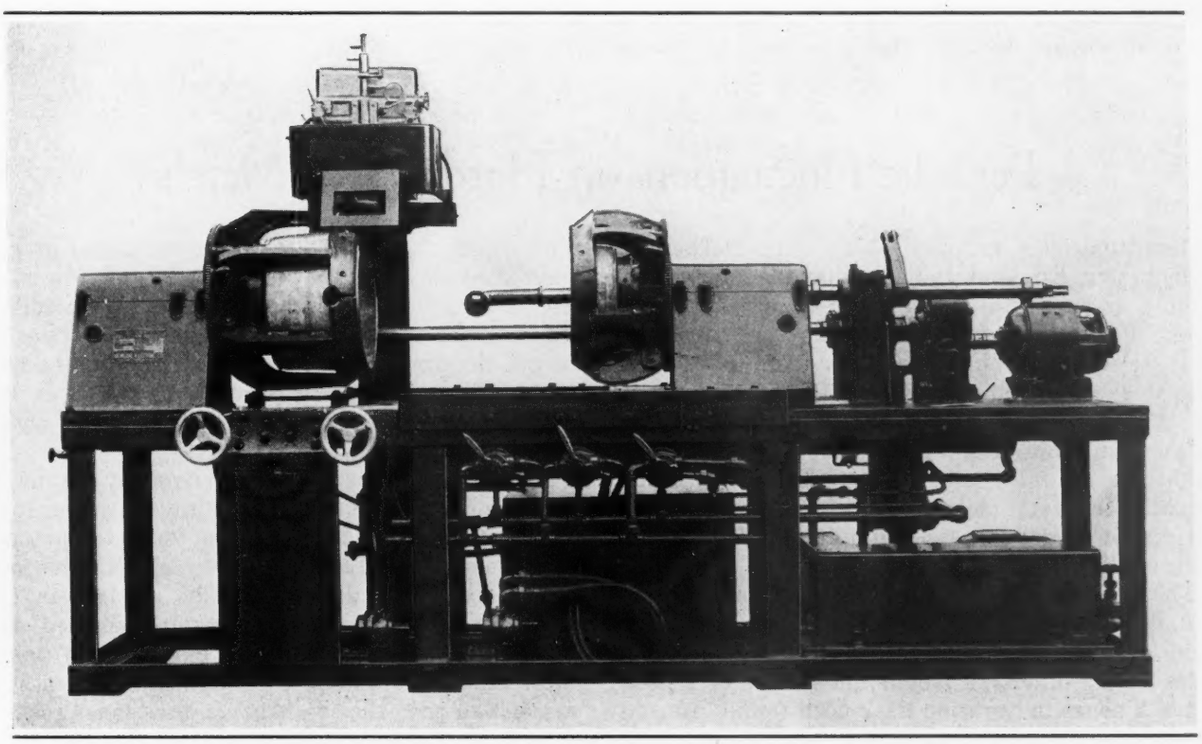


Fig. 1. Seam Welder Equipped for the Automatic Arc Welding of Stainless-steel Barrel Liners

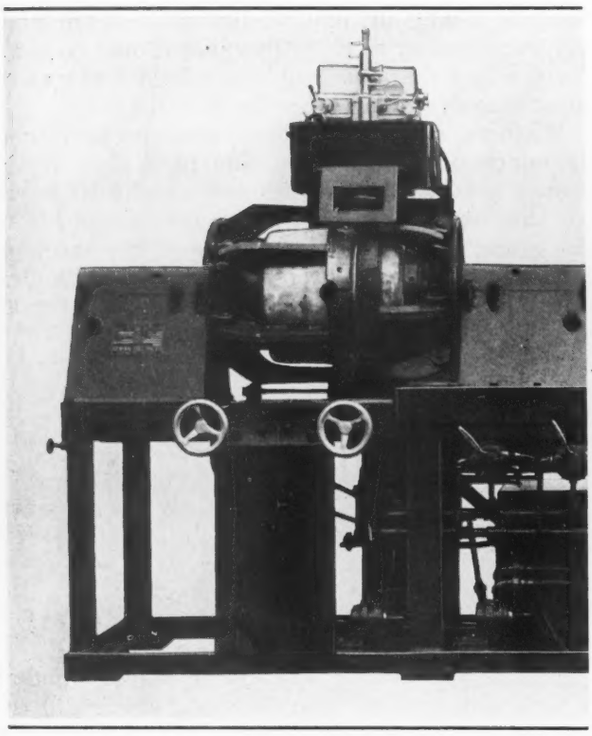


Fig. 2. Welding Stainless-steel Thimbles that Form Barrel Liner

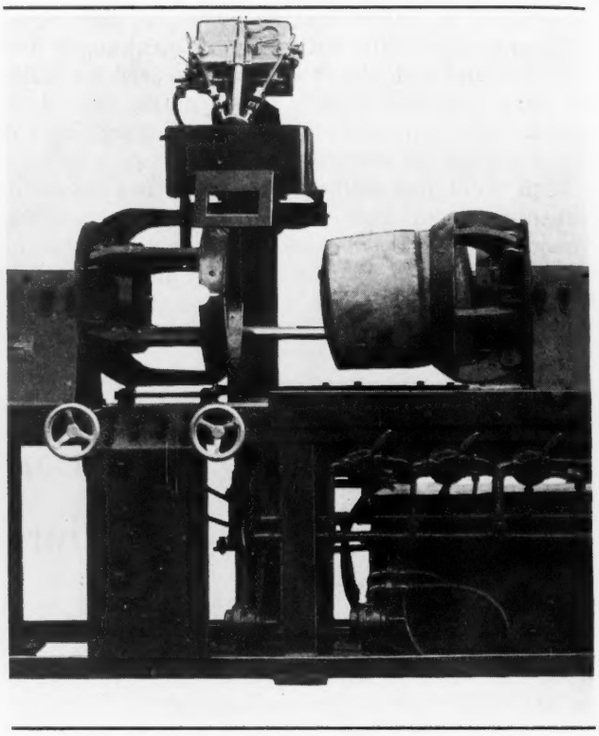


Fig. 3. Welded Liner Ready for Removal from Welding Machine

method, using a standard automatic welding head applied to the outside of the casing. The casing is, of course, rotated through a full 360-degree turn to make a complete seam. The novel feature of this process is the application of hydrogen to the inner surface of the seam while the weld is being made on the outside. The hydrogen is applied directly beneath the arc, and the resulting seam is smooth, bright, and free from porosity. As soon as the weld is completed, the clutch jaws on the head are released and the tail-piece is withdrawn, taking with it the completed lining, as shown in Fig. 3. The time for making a complete weld for a 16-inch barrel, including the time for setting up the thimbles and removing the completed liner, is a little less than two minutes.

Periodic Fluctuations in Hardness of Metals

Investigations made by Edward G. Herbert of Manchester, England, indicate that the hardness of metals under certain conditions is subject to periodic fluctuations or pulsations. The vibrations of these waves or pulsations vary from a few minutes to several hours per cycle. The pulsations can be set in motion by various agencies, of which heat, magnetism, and mechanical deformation of the metal are the most usual. They have been found to occur in every metal so far investigated—in a variety of steels, brasses, aluminum alloys, pure iron, gold, nickel, and carbon.

The cycles are more rapid in hot metals than in cold, the most rapid pulsation actually measured being one of 24 minutes per cycle in gold at 169 degrees F. In other hot metals, pulsations of 1 hour to 1 1/2 hours in duration have been found. In cold metals, the frequency is about 6 hours per cycle.

These pulsations are obviously of electro-magnetic origin, because they can be stabilized at any selected phase by placing the metal for a few minutes in a strong magnetic field. This may result in a permanent change in the physical properties of the metal. Mr. Herbert states that there is no reason to believe that these fluctuations differ, except in speed, from the more rapid vibrations of light, heat, radio waves, etc.

These fluctuations were discovered by means of hardness tests made at frequent intervals over long periods of time. The hardness was found to fluctuate in a periodic or wave-like manner. The fluctuations are believed to be due to periodic changes in the electro-magnetic force of cohesion between the crystal slip planes on which deformation takes place under the influence of a hardness test. A variation of the cohesion between the planes results in a corresponding variation in the resistance to slip, and hence in the "hardness."

What a Shop Executive Should Know About Cutting-Tool Materials

A Brief Review of the General Application of Carbon and High-Speed Steel, Stellite, and Carbide Tools in the Metal-Cutting Industries

By ROBERT C. DEALE, Industrial Engineer

WHILE there are a number of materials that can be used in making the tools employed in the cutting of metals, those generally used fall in a relatively small number of groups, as follows: (1) Carbon tool steel. (2) Fast finishing steel. (3) High-speed steel (including the various analyses usually called super high-speed steels). (4) Stellite. (5) No. 548 alloy. (6) Tungsten and tantalum carbide.

Carbon steel tools, far from becoming obsolete, are still used for approximately 15 per cent of the metal cutting in this country. Carbon steel has two definite fields. First, on many small parts, the cutting speeds are limited by the speeds at which it is possible to operate the machine, rather than by the effectiveness of the tool. For example, it would be necessary to run a 1/16-inch drill at 12,200 revolutions per minute in order to obtain a satisfactory cutting speed for brass. As few of the older drilling machines are designed for such speeds, most small twist drills are made of carbon steel and not of high-speed steel. Such drills have the added advantage of being tougher, and consequently are less subject to breakage. For the same reasons, carbon steel tools can be used to advantage in many lathe operations on small parts.

The other field is that in which a relatively low cutting speed is necessary for other reasons; here the high cold hardness of a good grade of carbon steel makes it superior, for this particular application, to a high-speed steel. Instances of such use are the turning of chilled cast-iron rolls in roll lathes having piano rests, and some finishing cuts, particularly in the planing of cast iron.

In this connection it is of interest to note that the number of carbon steel drills made and used last year equalled the number of high-speed steel drills made. It is probable that the same is true of taps, reamers, and threading dies.

Fast finishing steels are very similar to carbon steels in that they have a very high cold hardness. In addition, they contain enough alloying elements to enable them to retain their hardness somewhat better at the higher speeds than is possible with the straight carbon steels. Steels of this class are usually employed for the same purposes that carbon steel tools are used, but where better performance is desirable.

Some form of high-speed steel is used for approximately 80 per cent of the metal cutting in this country. These steels include the following variations: (1) The standard "18-4-1" brand. (2) The "14-4-2" type. (3) High-vanadium steel. (4) The 18-4-1 steel with approximately 5 per cent cobalt. (5) The 18-4-1 steel with approximately 8 per cent cobalt. (6) The 18-4-1 steel with approximately 12 per cent cobalt. (7) Molybdenum steel. (8) The 14-4-2 steel containing cobalt.

The 18-4-1 steels, which contain 18 per cent tungsten, 4 per cent chromium, and 1 per cent vanadium, are the standard tool steels in this country, being used for 65 per cent of all the cutting of metals. This type is a very satisfactory general-purpose steel, as it can be easily forged, is relatively insensitive to variations in heat-treatment, and possesses considerable physical strength in addition to a high red-hardness. A steel of this analysis is used for most of the high-speed steel tools that are bought in a completed condition, such as drills, taps, and milling cutters. It is of particular value in that it is applicable to practically all machine shop operations. A properly heat-treated tool made of this steel, of a size proper for the size of the machine, can usually take a cut as heavy and as fast as the average machine tool in the shop (which is often ten years old) will stand.

Steel of the 14-4-2 analysis, which contains 14 per cent tungsten, 4 per cent chromium, and 2 per cent vanadium, has substantially the same properties as the 18-4-1 steel, except that it is much more sensitive to heat-treatment and is consequently more difficult to harden properly. It is used to the extent of approximately 11 per cent of the total cutting-tool applications in this country.

The high-vanadium steels, which are usually of the 18-4-2 or 18-4-3 types, have not yet been generally adopted by industry. There is little data available as to their effectiveness, but such as there is indicates that they can be run at cutting speeds appreciably above those possible with the standard steels, and that their qualities are similar to those of the cobalt steels. No data are available as to the sensitivity of such steels to heat-treatment, although it is believed that their high carbon content would make surface decarburization probable.

The Cobalt Steels Have Many Uses for Difficult Metal Cutting

Steels containing 5 to 8 per cent cobalt have been on the market for some time, but have only recently become at all popular. They usually have an 18-4-1 base, although at times the 14-4-2 base is used. They are recommended by the makers for the cutting of hard metals, such as the alloy steels, where it would be difficult to use a standard steel. They are even recommended for the cutting of high-manganese steels, which are almost impossible to cut with ordinary tool materials.

These steels are believed to be very satisfactory for general machine shop use, where it is desired to operate at higher cutting speeds than are possible with steels of standard analyses. The available data seem to indicate that a 5 per cent cobalt steel can be operated at a speed approximately 7 to 11 per cent higher than a similar steel without cobalt under equivalent conditions. The 12 per cent cobalt steel has approximately 5 per cent higher cutting effectiveness than the 5 per cent steel.

There is little demand at present for a 14-4-2 steel containing cobalt. Such a steel is equivalent in cutting qualities to the 18-4-1 steel containing cobalt, and is appreciably more sensitive to conditions of heat-treatment.

Cobalt steels are relatively insensitive to varying conditions of heat-treatment, although they require high hardening temperatures. Unless great care is taken in maintaining the atmosphere of the furnace at a point where it is chemically inert, there is a tendency for a surface scale and a soft skin to form, particularly when adequate hardening temperatures are used.

The Possibilities of Molybdenum Steels

Considerable work has been done with steels containing molybdenum in place of part, or all, of the tungsten. As practically all of the tungsten used in this country must be imported, there is the possibility that the tungsten supply might be cut off in time of war. For this reason, the Ordnance Department of the United States Army has taken the lead in the development of molybdenum high-speed steel.

It has proved possible to make a steel containing approximately 9 per cent molybdenum, 4 per cent chromium, and 1 per cent vanadium that is substantially equivalent in cutting properties to the standard 18-4-1 steel. Such a steel is, however, difficult to manufacture and forge, and has a tendency to be irregular. For these reasons, it does not now seem probable that molybdenum steel will be used to supersede tungsten steel under normal conditions. Several manufacturers of tool steel use small percentages of molybdenum in steels that are predominantly of the tungsten type. In such cases, the molybdenum has the effect of an increase in the tungsten content. It is seldom present in sufficient quantities to give perceptibly different operating conditions.

Stellite is a cast alloy of tungsten, chromium, and cobalt, which is used for approximately 3 per cent of all metal cutting. It is used largely in the form of tips which are welded to a tough carbon or alloy steel shank, or in the form of bits which are used in a tool-holder. Its use is confined to turning, planing, and face-milling. It has considerably greater red-hardness than high-speed steel, so that it may be run at appreciably higher cutting speeds. It is inclined to be brittle, and consequently must be used very carefully with heavy feeds to prevent chipping of the cutting edge. Care must be taken to avoid stopping the work with the tool under cut, particularly when a heavy feed is used. Stellite is of the greatest value when cutting cast iron and cast bronze.

The No. 548 alloy is a tool material that can be forged to shape, machined, and then hardened, the same as high-speed steel. It appears to have very desirable cutting properties, and seems to be an intermediate tool material between high-speed steel and tungsten carbide.

The Carbide Tools are Constantly Finding New Applications

The tungsten- and tantalum-carbide tools form a group that appear still to be somewhat in the experimental stage, although they are being used for approximately 2 per cent of the metal cutting in this country. They are formed of crystals of tungsten or tantalum carbide, bonded in a matrix, which usually is made up largely of cobalt. These tools, which are very hard and brittle, have somewhat similar applications to Stellite, but can be used at appreciably higher cutting speeds. They are usually employed with light feeds and high cutting speeds, as the material has little elasticity and consequently tends to set up a concentration of stresses on the cutting edge rather than to deform sufficiently to allow a distribution of stress. As a result, they tend to chip at the cutting edge unless carefully used. Because of their cost, they are always used in the form of tips welded or brazed to a steel shank.

Carbide tools have proved to be particularly valuable in machining abrasive materials, such as the molded plastics, sandy cast iron, or silicon aluminum alloys. They are also very valuable where the set-up time of a machine is high, and it is desired to run a considerable length of time between tool grindings. They are recommended for general-purpose work, but it is believed that it is difficult to show appreciable savings on machines which have not been designed for the use of carbide tools. Because of their brittleness, any tendency toward chatter is likely to chip the cutting edge. For this reason, rigid machine tools must be used, if the speeds possible with high-speed steel tools are to be appreciably exceeded.

Low-Cost Press Tools for Making Clamp

By PETER L. BUDWITZ, Meriden, Conn.

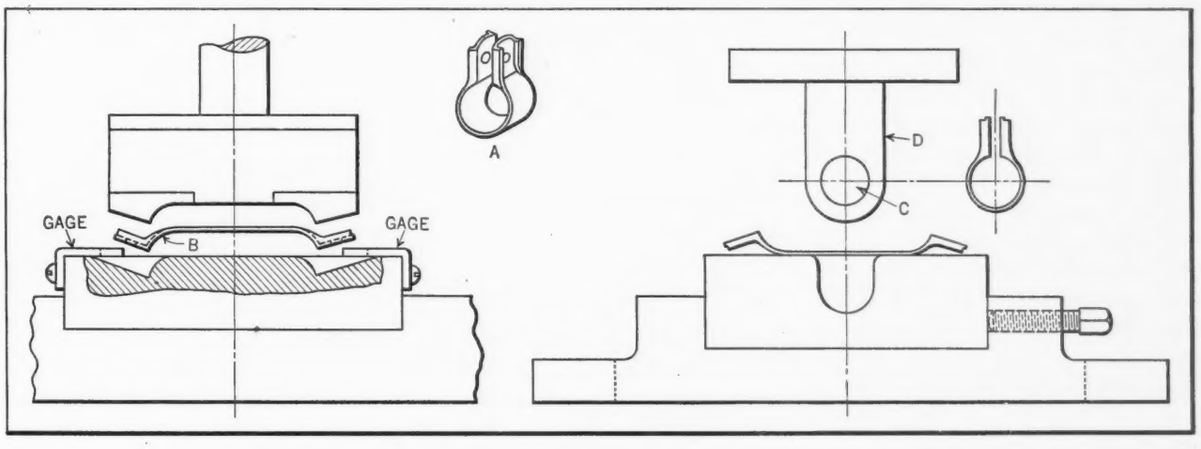
When a manufacturer receives a small-lot order or when a new product is being developed that requires a certain amount of experimental work, it is necessary to keep tool costs as low as possible. The press tools shown in the accompanying illustration are typical examples of low-cost tools designed for the production of a limited number of special sized sheet-steel clamps similar to the one shown at *A*. The blank pieces were cut off and pierced at each end in a preliminary operation.

The die for the first forming operation is shown in the view to the left, the straight piece being placed in the nest formed by the gages at each end of the die. As the punch descends, it bends the ends of the piece, forming two shoulders, as shown, and also forms part of the curvature, as at *B*. The final forming tool, shown in the view to the right, is merely a block containing a semicircular form. The work-piece is placed on the die in the position illustrated, and as punch *C* descends, it forces the piece into the semicircular form, thus completing the bend. Punch *C* is a round stud secured in plate *D*, and has a diameter equal to the inside diameter of the finished clamp.

Air-Operated Vise for Butt-Welding Machine

By CHARLES C. TOMNEY, Chief Tool Designer
Carrier Engineering Corporation, Newark, N. J.

The air-operated vise used on the Thompson butt-welder shown in Fig. 1 has been in continuous use for quite a few years and has required practically no attention. This machine is employed for welding bent lengths of pipe to form circulating coils. The two pieces of pipe to be joined are placed in the jaws *L* and *M* and the air is admitted to the air cylinders that operate these jaws. This serves to clamp one piece of pipe in the stationary jaw *L* and



Two Low-cost Dies Used in Producing Clamp Shown at A

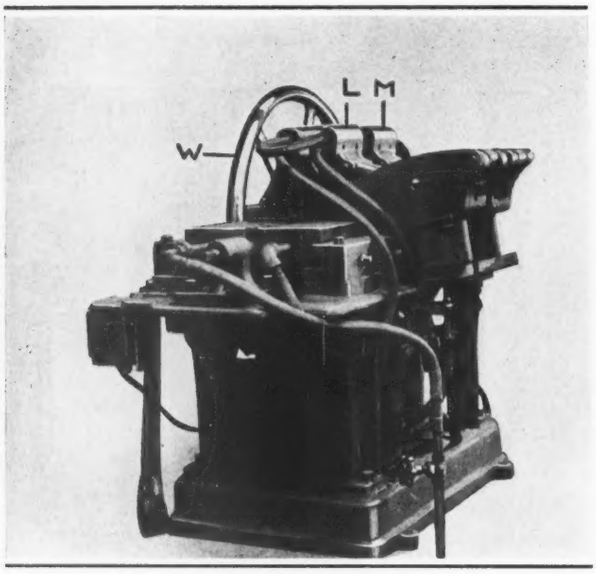


Fig. 1. Butt-welding Machine Equipped with Air-operated Vise Jaws for Holding Pipe

the other piece in the jaw *M*. The piece in jaw *M* is then moved forward into contact with the piece in the stationary jaw, in the usual manner, by operating the handwheel *W*.

The construction of the air cylinders, one of which is employed for each jaw, is shown in Fig. 2. This cross-sectional view also shows the manner in which the piston transmits the clamping pressure to the movable jaw. The air cylinders are made of cast iron. The diameter of the piston *B* is 4 inches. The levers *C* are also made of cast iron. The vise jaws or bodies *D* are made of gun-metal, and the false jaws or inserts *E* are made of copper. The false jaws are water-cooled, as indicated by the illustration. It is necessary to renew jaws *E* about twice a year. This is the principal reason for having these jaws separate from the bodies *D*.

The table *F* of the machine is also water-cooled. The tubes by which the cooling water is conducted to and from the false jaws *E* and the table *F* are shown in Fig. 1. Steel plates bored to fit over the two steel pins *O*, which project beyond each side of the bodies *D*, serve to hold the jaws together at point *N* about which the movable jaw swings or pivots when air is admitted to the operating air cylinder *A* by opening the air inlet valve shown at *H*.

Torque Testing Fixture

By F. P. SMITH

Sometimes the amount of force or torque applied in tightening screws or studs must be held to a predetermined amount within quite close limits. Too much force may distort the parts being assembled or cause breakage of the screws. On the other hand, if too little force is applied, the screws may not provide the necessary holding power or they may become loose.

To prevent such occurrences, wrenches and screwdrivers have been equipped with friction clutches adjusted to slip when a given torque is applied and to positively transmit a given amount of turning force before slippage occurs. When a large number of screwdrivers or wrenches are equipped with clutches of this kind, it is desirable to have a torque testing fixture, such as shown in the accompanying illustration, which will show at a glance if the clutch is properly adjusted. Testing fixtures of this kind are also used in adjusting friction clutches used on driving shafts for small mechanisms of various kinds.

The fixture illustrated is adjusted to indicate when the effort required to turn shaft *Z* of the mechanism under test is within the torque tolerances. When the crank *L* is turned in the direction indicated by the arrow *E*, the collar *D* advances to the left, sliding on shaft *A*. When the end of collar *D* reaches line *Y*, it indicates that the minimum amount of torque required for the mechanism under test is being applied.

If the collar *D* reaches line *X*, the operator knows that the maximum permissible torque is being applied to shaft *Z*. The length *W* of shaft *A*, between

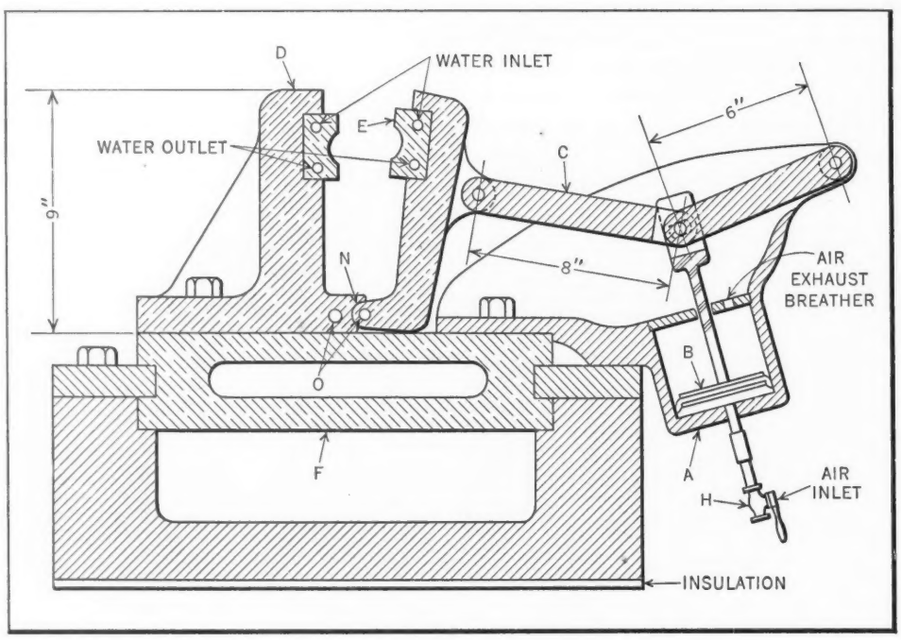
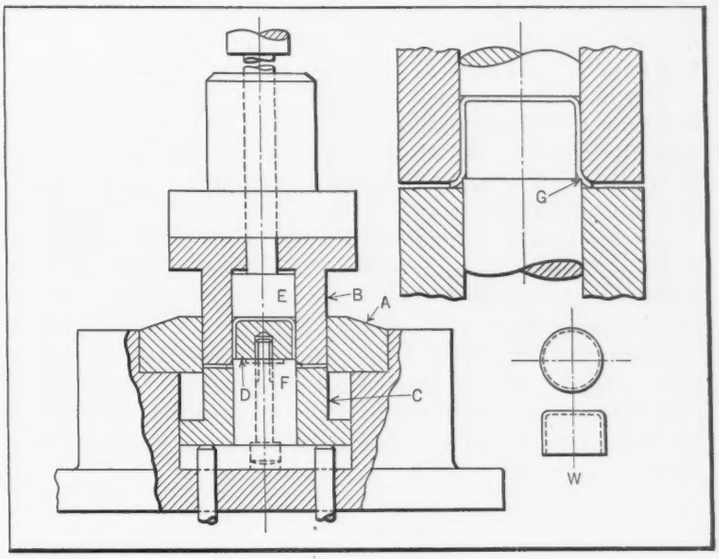


Fig. 2. Cross-section of Vise Jaws and Pneumatic Equipment Used on Machine Shown in Fig. 1

the lines *X* and *Y*, which represents the tolerance band, is painted red. If the end of collar *D* slides outward to any position on this red band and remains there while the handle *L* is being turned, the torque applied in turning shaft *Z* of the part under test is within the predetermined limits for which the testing device has been adjusted.

Shaft *A* is driven by sleeve *B* through the torsion spring *C*. Collar *D*, which is driven by pin *F*, fitted in keyway *G* of the shaft *A*, also has a spiral slot *H* in it. The pin *J* of sleeve *B* operates in this slot. Spring *C* is twisted or preloaded when the fixture is assembled, so that end *K* of slot *H* (shown in the enlarged view) is held against pin *J*. This normally prevents rotation of shaft *A* relative to sleeve *B* and unwinding of spring *C*.

When sleeve *B* is turned in a clockwise direction, the resistance of shaft *Z* causes spring *C* to wind up, and, therefore, the movement of shaft *A* lags relative to the movement of sleeve *B*. Since the gaging collar *D* rotates with shaft *A*, the lag in rotation causes it to slide outward, due to the action of pin *J* in the spiral slot *H*. This outward movement continues until the torque exerted by spring *C* equals that of shaft *Z*. The size of spring *C* and the amount of preloading must, of course, be made to suit the requirements of the clutch or mechanism to be tested. Master mechanisms having torque resistances of known values are used in positioning the band *W* and in determining its width. The master mechanisms are also used occasionally to check the accuracy of the torque testing fixture.

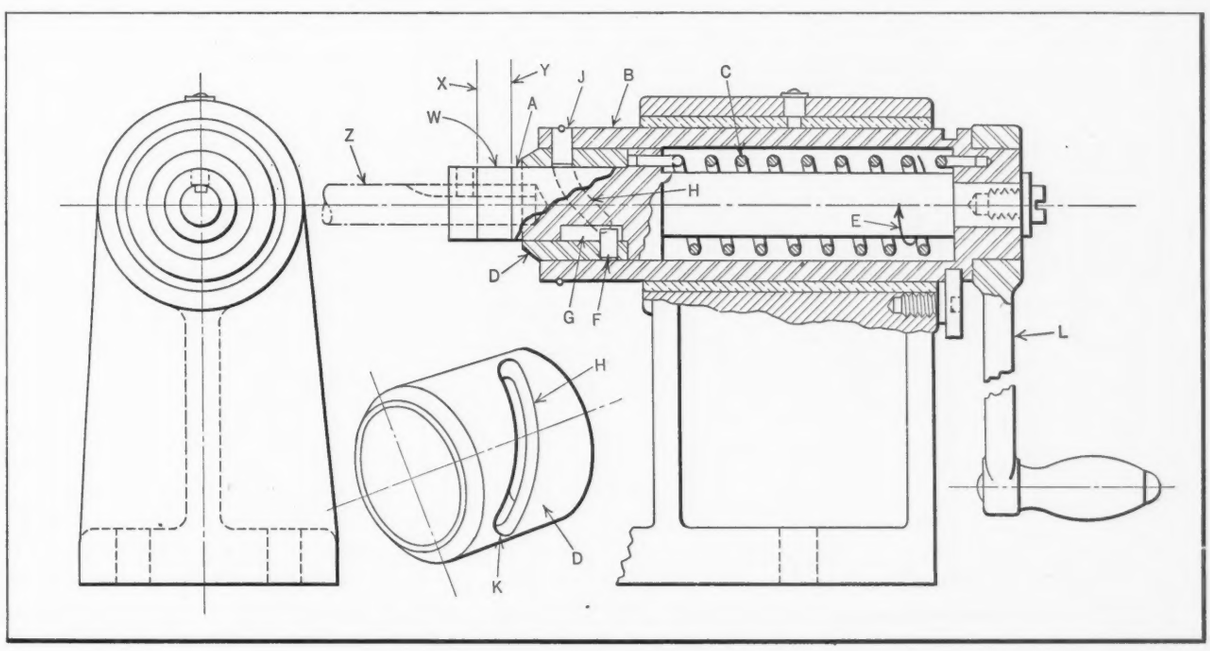


Pinch-off Die that Blanks, Draws, and Trims Shell to Length

Pinch-Off Die for Drawing and Trimming Shells

By H. R. SCHMIDT, Philadelphia, Pa.

The shell shown at *W* in the accompanying illustration is blanked, drawn, and trimmed to length in one operation by the die shown to the left. Except for trimming shoulder *G*, the punch and die is of the conventional combination blanking and drawing type used in a single-action press. The die consists of the blanking ring *A*, the blanking and drawing punch *B*, the floater or pressure-pad *C*, the drawing button *D*, and the mechanically operated ejector *E*. The diameter of the trimming



Testing Fixture which Indicates at a Glance if the Torque Required to Turn Shaft Z is within Predetermined Limits

punch *F* is equal to the diameter of the drawing button *D* plus twice the thickness of the shell stock, and punch *F* is a tight fit in the bore of the punch *B*.

The blanking diameter of punch *B* is such that it produces a blank somewhat larger than is necessary for forming the shell. Metal must therefore be trimmed off to make the shells uniform in length and square across the open ends.

In operation, the punch draws the blank over the drawing button *D* and trims it by pinching the surplus metal against the corner of the trimming punch, as shown at *G*.

This operation leaves a ring of scrap resting on the pressure-pad. Upon the return stroke of the press, the scrap is brought to the surface of the die and brushed or blown off, and the shell is ejected from the punch.

Chuck for Truing up and Clamping Bevel Gear Blanks by the Finished Bore

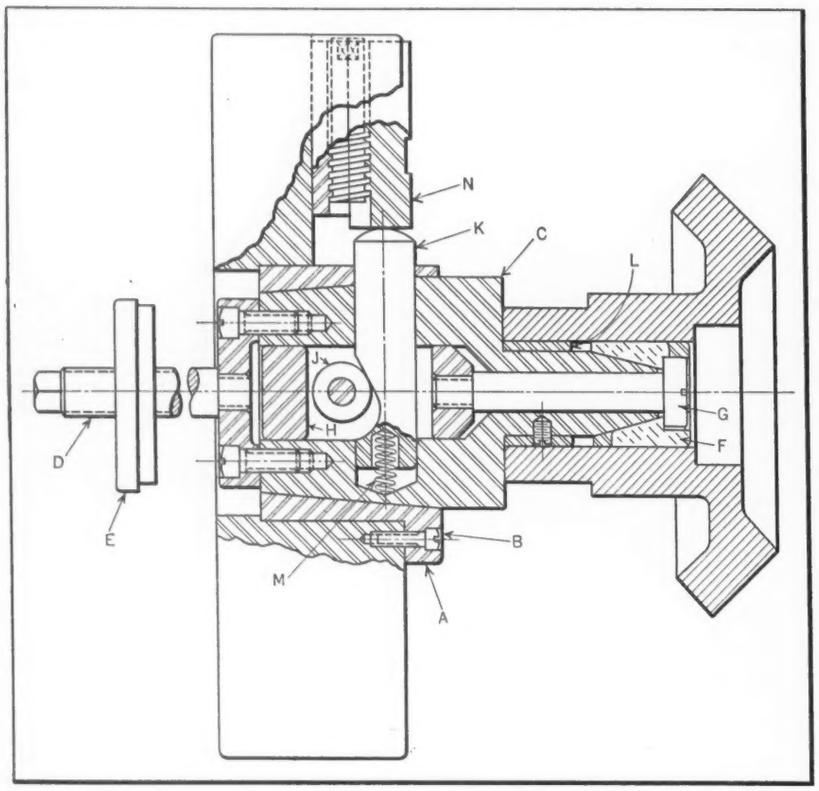
By I. F. YEOMAN, Elkhart, Ind.

In the accompanying illustration is shown a lever-operated chuck equipped with an expanding arbor for holding bevel gear blanks while performing turning operations on the outer surfaces. The fixture is so designed that it can be used for holding gear blanks having hubs of different lengths and with different bore diameters by simply changing bushings. Adapter *A* of the fixture is pressed into the chuck and fastened securely in place by screws *B*.

The adapter is bored and ground to receive the tapered end of arbor *C;* the arbor is retained by the draw-rod *D* and washer *E*, which clamps against the outer end of the lathe spindle. The outer end of arbor *C* is ground to receive the tapered bushing *F*, and is bored and ground internally to receive the draw-rod *G* and the slotted sleeve *H*. The sleeve carries the roll *J* and also is bored to receive the pin *K*. The tapered flat surface on the pin comes in contact with roll *J*. The outer end of pin *K* rests against one of the movable jaws *N* of the chuck.

Since there is considerable variation in the lengths and diameters of the hubs, several arbors are required. For longer hubs, a pilot bushing is all that is necessary; where the lengths are the same and only the diameters vary, a bushing *L* and an extended bushing *F* are sufficient. For the short hubs, another arbor and expanding bushing only are required. The arbors and all movable parts are hardened and ground.

The operation of the device is as follows: When the chuck is closed, the inward movement of the jaw *N* forces pin *K* in, and the wedging action of the tapered flat on pin *K* against the roll *J* moves sleeve *H* and draw-rod *G* back, thus pulling the bushing *F* over the tapered end of arbor *C* to the clamping position. Spring *M* is provided to insure the return of pin *K* to the releasing position. The independent adjustment of jaw *N* over the pin *K* provides for exerting any clamping pressure desired for gripping the work.



Lever-operated Lathe Chuck Equipped with Expanding Arbor for Holding Bevel Gear Blanks

* * *

In an editorial in July MACHINERY, "Another New Product of Industry that May Open up Active Markets," attention was called to the need for inexpensive tractors for the small farm. This idea is also voiced by Earl Bartholomew, of the engineering laboratory of the Ethyl Gasoline Corporation, who, in a survey reported to the Society of Automotive Engineers, states that there is a "growing demand for tractors which would bear the same relation to the tractor industry that the $500 car does to the automobile industry. They would have to be light, cheap, dependable, and easily serviced." Mr. Bartholomew thinks that a high compression gasoline engine will show the lowest actual performance cost for a tractor of this size.

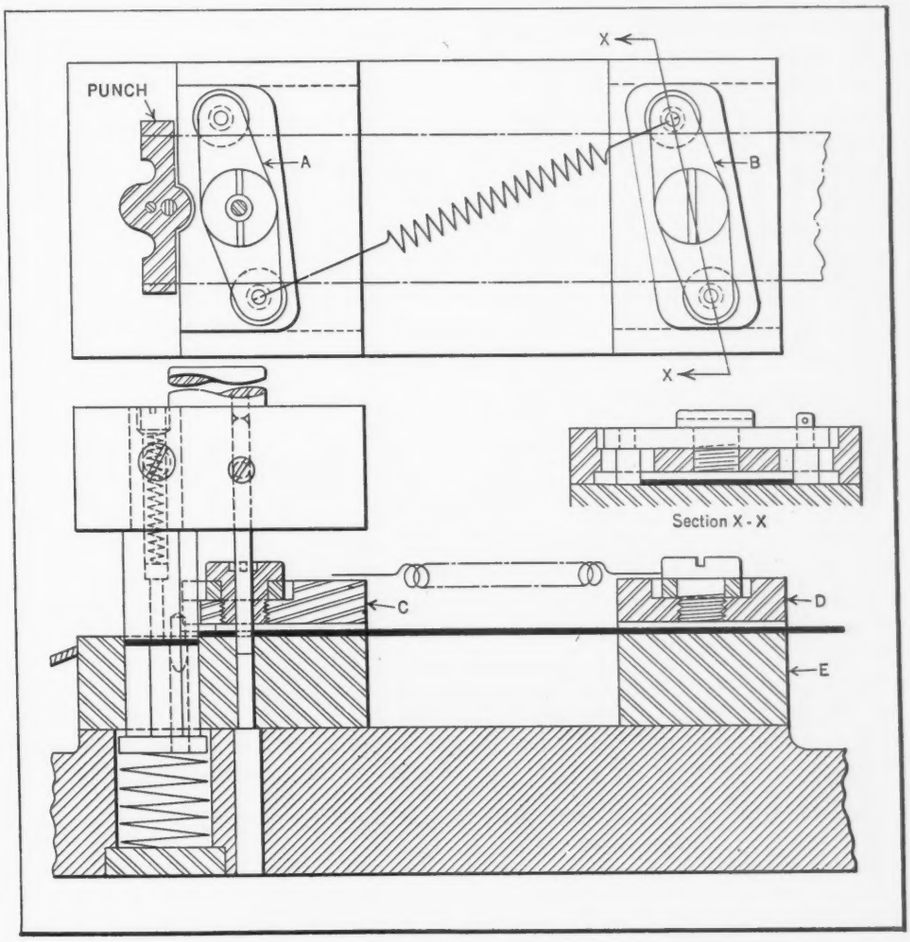
Method of Centering Strip in Die

By J. E. FENNO

For the sake of economy, blanking and forming dies are often made in such a way that the entire width of the strip is utilized for producing the blank. To guide the strip centrally through the die, regardless of any variation in its width, an equalizing device like that shown in the illustration is sometimes used.

This device is shown applied to a simple progressive die for making a pierced blank. It consists chiefly of the levers *A* and *B*, which are pivoted on shoulder-screws fastened in the stripper plate *C* and the guide plate *D*. Pins driven into the ends of the levers protrude downward, nearly touching the face of the die. The distance between the pins is slightly greater than the width of the strip. Hence, when the levers are rotated slightly, the pins will force the strip toward the exact center of the die.

In order to keep the pins in contact with the strip, a coil spring connecting one end of each lever is provided, as shown. It will be noted that the piercing punch passes through the center of the shoulder-screw on which the lever *A* turns. However, this condition is not always necessary, as this arrangement was used merely to facilitate the die lay-out in this particular case. In using the device described on very thin strips, it may be necessary to provide an auxiliary guide between the die and the guide block *E* to prevent the strip from buckling.



When the Entire Width of the Strip is Utilized in a Die, Spring-actuated Levers Equipped with Guide Pins Simplify the Centralizing of the Strip

* * *

A unique type of trailer rail car provided with arc-welding equipment and having a hand-operated derailing device for quick removal from the track has been developed by the Westinghouse Electric & Mfg. Co. for railway maintenance work, such as the building up of battered rail ends, frogs, and cross-over switches, and for bridge repair and structural work. The complete car can be removed from the track by one man, in order to clear the road for through traffic.

Why New Equipment is Bought

"The fundamental problem of the seller of industrial equipment at the present time is to prove to the buyer the net profit which will arise from the purchase of his equipment," said Herbert P. Bailey, president of the Rotor Air Tool Co., Cleveland, Ohio, in an address on the subject of "How to Make Industrial Sales Now," at the Industrial Marketing Conference of the American Management Association. Mr. Bailey emphasized the fact that today those who buy industrial equipment buy in order to reduce the cost of present production. This is in contrast to the major motive of the years 1928 and 1929, when buyers were considering ways of increasing production.

* * *

The cooling of heat-treatment quenching baths is one of the possible applications of a steam-operated cooler recently developed by the Elliott Co., Pittsburgh, Pa. This equipment can also be used in shops to supply cool water for drinking purposes or for air coolers and humidifiers.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

J. S. C.—What is the diameter of the smallest size wire commercially produced, and what methods are used in its production?

A.—The tungsten filament wire used in Mazda 6-watt incandescent lamps is so fine that it is almost invisible, being only 0.0004 inch in diameter. This wire is drawn from a bar of tungsten 3/8 inch square. In producing the wire, it is passed through ninety-five dies, nearly two-thirds of which are diamond dies. A bar 3/8 inch in diameter, 24 inches long, and weighing 1.33 pounds, is thus drawn to a length of 207 miles and to a diameter one-eighth to one-ninth that of the average human hair.

Effect of Verbal Agreement on Written Contract

G. E. H.—Some time ago I signed a written contract and agreed to pay $1500 for a machine to be delivered in December. The seller failed to make delivery and I cancelled the order. Soon afterward the seller and myself made a verbal agreement by the terms of which he agreed to deliver the same machine for $1300. The machine was not satisfactory, and after some controversy, he intends to sue me on the written contract for $1500. Is it a fact that I cannot give testimony to prove the oral contract?

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

One of the few acts that results in a verbal agreement being superior to a written one is where the contracting parties have agreed to cancel the written contract and subsequently entered into a new and oral agreement. Under these circumstances, the written contract is rendered ineffective and the parties must perform the obligations assumed in the verbal conversation.

For example, in a recent case (288 S. W. 897), it was shown that two parties entered into a valid and binding written contract. Several days later the contracting parties verbally agreed to cancel the prior contract and orally agreed to new obligations. When legal controversy arose, it was argued that testimony was not admissible to vary, alter, or cancel the original written contract.

The Court agreed that contracting parties cannot by verbal agreement vary or alter the terms of a written contract, but held this verbal contract valid and binding, because the written contract was cancelled and a new oral obligation assumed. The Court stated the law, as follows: "The rule that oral evidence is not admissible to contradict, vary, or alter the terms of a written instrument does not exclude the introduction of evidence to show that a written contract has been modified, altered, or, in fact, entirely rescinded by a subsequent oral agreement, the evidence not being for the purpose of varying the terms of the written instrument, but to show that it has become inoperative either in whole or in part by reason of a subsequent and independent agreement. It is immaterial how soon after the execution of the written instrument the new agreement was made."

Composition of Castings for Machine Bases

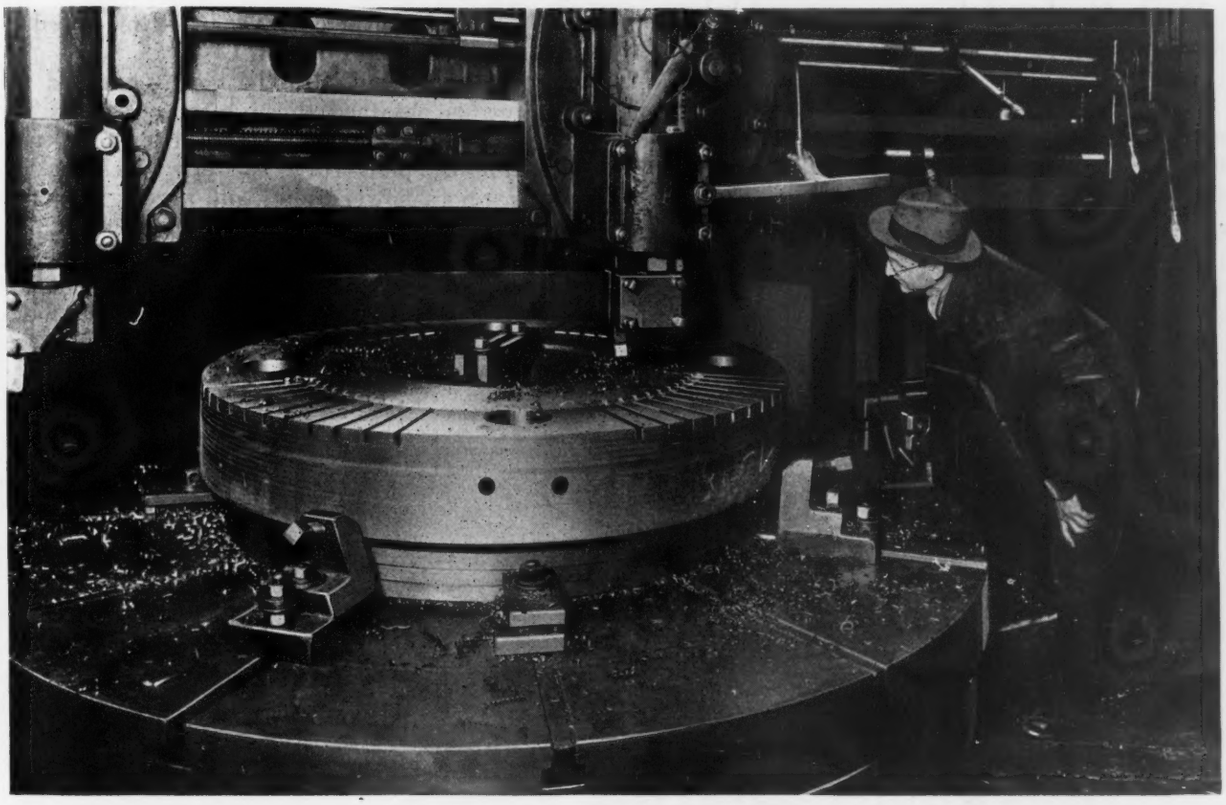
O. B. S.—Gray iron castings used for machine bases are frequently very difficult to machine on account of hard spots. Increasing the silicon content eliminates the hard spots to some extent, but this seems to weaken the castings and cause porosity. It is understood that similar difficulties in making castings for lathe beds have been overcome by the addition of nickel. What amount of nickel is used for such castings, and how are the density, finish, and machineability of the castings affected by such additions?

A.—An article in September, 1932, MACHINERY, page 1, entitled "Better Castings for Machine Construction," gives the composition of typical nickel-iron alloys used extensively by prominent machine tool builders for machine beds and a variety of smaller parts. According to this article, castings for machine tool beds and smaller parts, including castings for gears, have been greatly improved by the addition of 1 per cent nickel. It is claimed that both the tensile and transverse strength of a casting can be increased 30 per cent or more, in some cases, by the addition of less than 2 per cent nickel. This is accomplished with a corresponding increase in compressive strength without sacrifice of toughness. An important advantage gained by the use of nickel in cast iron is the improvement in the surface finish. Although more power is required to machine nickel alloy castings, this is more than compensated for by the freedom from hard spots. In fact, nickel iron castings with a hardness of about 240 Brinell will machine as readily as plain gray iron with a hardness of 200 Brinell.

Cutting Steel with Tantalum Carbide

By J. M. HIGHDUCHECK
Supervisor of Cutting Tools and Applications
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TANTALUM carbide has proved successful in machining steels of the mild or free-cutting grades, because the cratering action is practically negligible. The writer has applied tantalum-carbide tools widely in machining carbon steel forgings (S A E 1035), chrome-nickel steel (S A E 3435), chrome-molybdenum steel (S A E 4150), chrome-vanadium steel (SAE 6120), and steel castings.



Tantalum-carbide Tool Takes an Intermittent Cut over a Series of Grooves at a Speed of 90 Surface Feet per Minute

Tantalum-carbide tools have been satisfactory not only for continuous cuts, but also for intermittent cuts. The illustration shows a steel forging on which intermittent cuts were taken over a series of grooves at a speed of 90 surface feet per minute. The depth of cut on this job was about 3/16 inch and the feed was 1/16 inch.

Another interesting job that could be mentioned consists of machining circular forgings 22 inches in diameter containing from 0.65 to 0.75 per cent carbon and from 0.60 to 0.80 per cent manganese. This steel has a tensile strength of 110,000 pounds per square inch and a yield point of 56,000 pounds per square inch. When cobalt high-speed steel was used for machining this material, the tool only lasted for a width of 4 1/2 inches (the length of one cut) at a feed of 0.018 inch per revolution and a depth of cut of 5/8 inch. The speed of the work was 30 surface feet per minute.

With tantalum-carbide tools, an average of four cuts can be taken, even though the speed is increased to 120 surface feet per minute and the feed to 0.031 inch, the depth of cut remaining the same.

In order to obtain the best results from tantalum carbide, the set-up man and the operator must know the kind of steel that is to be machined, its hardness, the kind of lubricant to be used, and the nature of the cut—whether continuous or intermittent. Some long-practiced shop kinks must be avoided, such as hammering or tapping a clamped tool, dipping the tool shortly after grinding, stop-

ping the machine in a cut, pushing a dull tool, grinding the tool on wheels intended for sharpening high-speed steel tools, grinding the tip away from the cutting edge, and grinding the clearance angles on the periphery of a small wheel.

In making tantalum-carbide applications, spectacular performances should be avoided, as they are easily misunderstood. Failure to get successful results in many cases is due to trying to get too much. Speeds five to ten times greater than are used with high-speed steel are of laboratory interest only. The speed should be such as to permit safe working conditions and to insure the return of the tool investment on a competitive machining basis.

* * *

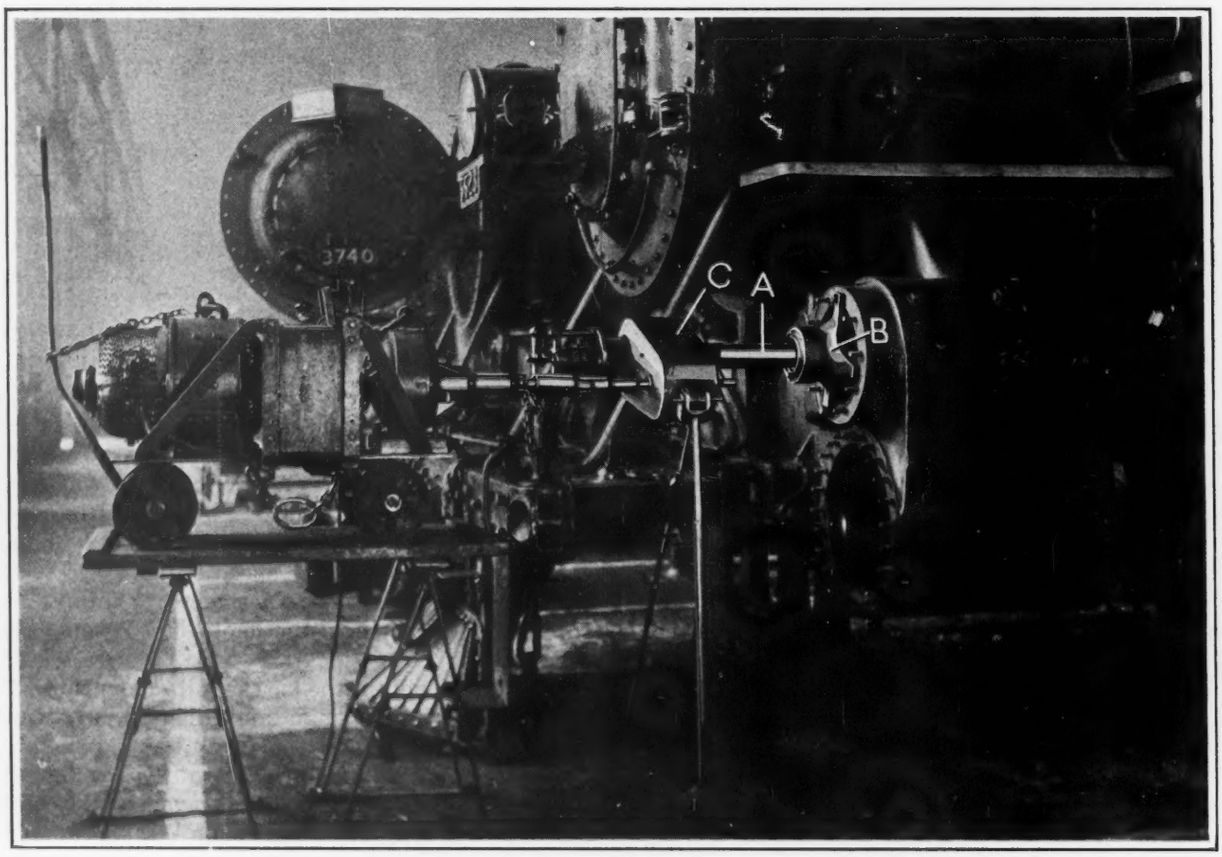
Both Ends of Locomotive Valve Chambers Bored at One Time

Piston-type locomotive valve chambers are rebored simultaneously at both ends in the Grand Trunk Railway Shops at Battle Creek, Mich., without dismantling the cylinder castings from the engine. This is done by means of the portable equipment illustrated. By the use of this equipment, both ends of a locomotive valve chamber can be bored in thirty minutes after the set-up has been made.

Boring-bar *A* is equipped with two heads. Each head has three cutters, two of which take roughing cuts while the third takes a finishing cut. The boring-bar is guided at the front end of the locomotive in a support *B* which is bolted to the cylinder casting. At the opposite end, it is guided in the hole of the valve chamber head. As this hole varies in diameter with different locomotives, the boring-bar is provided with a tapered sleeve equipped with four hardened and ground blades, which are adjustable radially to suit the diameter of the hole in the cylinder head.

On one side the boring-bar is hollowed out to accommodate a lead-screw which engages a nut on each boring head. The lead-screw is revolved on its own axis, in addition to revolving with the boring-bar, and thus feeds the boring heads forward 1/32 inch per revolution of the bar. There is no lengthwise bar movement. The cutting speed of the tools is 65 feet per minute.

Power for driving both the boring-bar and the lead-screw is obtained through gear-box *C*. The gear-box, in turn, is driven by the portable unit mounted on the platform at the left, which consists of a three-horsepower motor and a gear reduction unit. Universal joints and a telescoping shaft provide for conveniently attaching this unit to gear-box *C*. The same equipment is employed for boring cylinders, except that for such operations, only one head is used, and it is equipped with two tools instead of three.



Boring Both Ends of a Locomotive Valve Chamber Simultaneously

What Properties are Expected in Steels for Gears?*

A Review of the Principal Qualities in Steel that Should be Taken into Consideration in Selecting Materials for Gearing

By T. R. RIDEOUT, Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

THE qualities that steel should possess in order to meet the various service demands and manufacturing requirements, listed in the order of their importance, are as follows: (1) Ability to withstand wear; (2) strength; (3) static toughness; (4) impact toughness; (5) low amount of distortion; (6) machineability; (7) susceptibility to and ease of heat-treatment.

The reason for listing the ability to resist wear as being of primary importance is apparent when we consider that properly designed and correctly heat-treated gears give far less trouble from tooth breakage than from wear. Then, too, the fact that so little is known regarding the relative wearing qualities of the different heat-treated steels makes it of utmost importance. Tests have been made to determine the wearing qualities of heat-treated steels; but the results, the author believes, are not applicable to gears, because, first, most wear tests have been made with abrasives in order to expedite the testing, and second, no wear-testing machine available approximates the combined rolling and sliding action of gear teeth. Tests with gears have been made, to be sure, but generally by different experimenters; and the reports of results, due to the lack of a commercial measuring stick, are hardly comparable.

Most metallurgical authorities agree that tenaciousness, as well as hardness, is required for wear resistance. Just what tenacity is and how to measure it is a difficult question. It appears to be a function of toughness, grain size, and structure, which all affect hardness to a greater or less extent, as measured by conventional methods. It would seem, however, that heat-treated steels which show the highest hardness, measured either by an indentation machine or by the scratch test, should wear the best. In general, it may be said that steels having a high surface hardness and a fine grain structure, as indicated by the microscope, will wear well.

Strength and Toughness in Gear Steels

High strength in gear steels is a desirable feature, not only because it indicates the static load that can be carried without failure, but also because it is a measure of the fatigue strength or endurance limit. The endurance limit is the capacity of the steel to withstand repeated stresses or complete reversals of stress (which are characteristic of gear-tooth loads) without failure.

Static toughness is the ability to withstand loads and shocks without undue deformation. It is a function of the strength and ductility of the steel, but is not a quality susceptible of exact measurement.

Impact toughness, as measured by the Charpy or Izod machines, is an indication of the capacity of the steel to withstand shock or impact loads without failure by fracture. In general, impact strength seems to relate to the grain size (the finer the grain size the higher the impact strength), and though no exact relation has yet been found, it seems to be a function of the reduction of area.

What Steels Show Least Distortion in Heat-Treatment?

Decreased distortion is effected by using low quenching temperatures, rapid heating, and slow cooling at quenching. Low quenching temperatures can be obtained by the use of some of the alloy steels that have low critical points, principally the nickel and molybdenum steels. Slow cooling at quenching is obtained by the use of an oil bath, or for some of the less frequently used air-hardening steels, by cooling in the air.

The grain size of the steel used has an important but seldom recognized effect on the amount of distortion. Controlled and fine grain sizes have less tendency to become distorted. Lack of normalizing or annealing and normalizing at, or quenching from, too high temperatures also causes distortion.

The purchase of steel of the highest quality is an excellent way to reduce distortion or to *keep it uniform*—sometimes a more important point than the amount of distortion present.

Summarizing, the desirable qualities for obtaining the minimum of distortion are low critical temperatures for quenching, a slow rate of cooling for quenching, fine and controlled grain size, normalizing or annealing of the steel, clean steel of the

*Abstract of a paper read before the Eighteenth Annual Meeting of the American Gear Manufacturers' Association at Wilkinsburg, Pa.

best quality, and the best of furnace and quenching technique.

The machineability of a steel, like its wearing qualities, is a function of the hardness and toughness of the steel. On gears that are machined before heat-treating, good machineability is obtained by normalization. The hardness at which machining after heat-treatment is practicable and economical varies considerably with the type of steel, the treatment, and the amount of hardness penetration. Some of the alloying elements tend to make machining difficult.

The susceptibility of the different steels to heat-treatment and the ease with which they can be treated is quite well understood. The carbon steels and most of the alloy steels can be treated with equal ease.

Having decided upon the qualities that the gear must possess and the characteristics necessary to fulfill these qualities, the engineer must select a steel and heat-treatment that have, in the highest degree, the necessary characteristics.

Classification of Gear Steels

Gear steels may be divided into two general classes—the plain carbon and the alloy steels. Alloy steels are used to some extent in the industrial field, but heat-treated plain carbon steels are far more common. The use of untreated alloy steels for gears is seldom, if ever, justified, and then, only when heat-treating facilities are lacking.

The points to be considered in determining whether to use heat-treated plain carbon steels or heat-treated alloy steels are: Does the service condition or design require the superior characteristics of the alloy steels, or, if alloy steels are not required, will the advantages to be derived offset the additional cost? For most applications, plain carbon steels, heat-treated to obtain the best of their qualities for the service intended, are satisfactory and quite economical.

The results of recent investigations and a study of existing data have convinced the author that the advantages obtained from using heat-treated alloy steels in place of heat-treated plain carbon steels are as follows:

1. Increased surface hardness and depth of hardness penetration for the same carbon content and quench.
2. Ability to obtain the same surface hardness with a less drastic quench and, in the case of some of the alloys, a lower quenching temperature, thus giving less distortion.
3. Increased toughness, as indicated by the higher values of yield point, elongation, and reduction of area.
4. Finer grain size, with the resulting higher impact toughness and increased wear resistance.
5. In the case of some of the alloys, better machining qualities or the possibility of machining at higher hardnesses.

When Casehardening Steels are Chosen

Each of the two general classes may be further subdivided as follows: (1) Casehardening steels; (2) full-hardening steels; and (3) steels that are heat-treated and drawn to a hardness that will permit machining.

The first two—casehardening and full-hardening steels—are interchangeable for some kinds of service, and the choice is often a matter of personal opinion. Casehardening steels with their extremely hard, fine-grained (when properly treated) case and comparatively soft and ductile core are generally used when resistance to wear is desired. Casehardening alloy steels have a fairly tough core, but not as tough as that of the full-hardening steels.

There is a considerable difference of opinion regarding the ability of the casehardened steels to withstand shock loads. Owing to the tendency of the extremely hard and brittle case to crack or spall under shock loads, the author's preference is to make use of the full-hardening steels for such applications.

In order to realize the greatest benefits from the core properties, casehardened steels should be double-quenched. This is particularly true of the alloy steels, because the benefits derived from their use seldom justify the additional expense, unless the core is refined and toughened by a second quench. The penalty that must be paid for the additional refinement is increased distortion, which may be excessive if the shape or design is not all that it might be.

When to Use So-Called "Full-Hardening" Steels

Full-hardening steels are used when great strength, high endurance limit, toughness, and resistance to shock are required. These qualities are governed by the kind of steel and treatment used. Fairly high surface hardnesses are obtainable in this group, though not so high as those of the casehardening steels. For that reason, the resistance to wear is not so great as might be obtained, but when wear resistance combined with great strength and toughness is required, this type of steel is superior to the others.

Full-hardening steels become distorted to some extent when hardened, the amount depending upon the steel and quench used. For that reason, full-hardening steels are not suitable for high-speed gearing where noise is a factor, or for gearing where accuracy is of paramount importance, except, of course, in cases where grinding of the teeth is practicable.

The medium and high carbon percentages require an oil quench, but a water quench may be necessary for the lower carbon contents, in order to obtain the highest physical properties and hardness. The distortion, however, will be greater with the water quench.

Heat-Treatment that Permits Machining

When grinding of the teeth is not practicable and a high degree of accuracy is required, hardened steels may be drawn or tempered to a hardness that will permit the cutting of the teeth. This treatment gives a highly refined structure, great toughness, and, in spite of the low hardness, excellent wearing qualities. The lower strength is somewhat compensated for by the elimination of the increment loads due to the impacts which are caused by inaccuracies.

When steels that have a low degree of hardness penetration from surface to core are treated in this manner, the design cannot be based on the physical properties corresponding to the hardness at the surface. Since the physical properties are determined by the hardness, the drop in hardness from surface to core will give lower physical properties at the root of the tooth, where the stress is greatest.

The quenching medium may be either oil, water, or brine, depending on the steel used and hardness penetration desired. The amount of distortion, of course, is immaterial, because the machining is done after heat-treating.

The 1933 Census of Machine Tools

The Bureau of the Census announces that, according to a preliminary tabulation, the value of machine tools made in the United States in 1933 amounted to $22,857,875, a decrease of 58.5 per cent, as compared with 1931 (the last preceding census year), when the value was $55,109,887. The accompanying table gives detailed figures for different classes of machine tools.

In 1933, there were 239 establishments engaged in the manufacture of machine tools (279 in 1931). The average number of wage earners employed, not including salaried officers and employes, was 12,683 (compared with 21,262 in 1931), and the wages paid amounted to $12,584,182 (as compared with $25,149,816 in 1931). The decrease in wage earners, it will be noted, is about 40 per cent.

Production of Machine Tools in 1933

Kind of Machines	Number	Value
Machine tools, total value	....	**$22,857,875**
Bending machines	341	225,112
Boring machines:		
Horizontal*	98	440,164
Vertical	20	78,563
Other	....	366,084
Drilling machines:		
Horizontal	†	304,017
Vertical		
Multiple-spindle other than sensitive	45	154,137
Standard	233	105,132
Sensitive, multiple-spindle	49	61,793
Radial	†	304,106
Other special, including automatic, single-spindle sensitive and vertical universal-head	....	695,528
Forging machines:		
Drop-hammer (impression die)	22	76,755
Other	....	375,934
Gear-cutting machines	†	1,028,288
Grinding machines:		
Cutter and tool	171	202,557
External cylindrical	319	1,045,153
Surface	167	329,743
Other, including disk, internal cylindrical, and snagging grinders	....	2,011,738
Honing machines	55	125,320
Lathes:		
Bench	87	179,770
Engine	2,054	1,136,598
Automatic	242	1,185,203
Turret (horizontal)	201	516,372
Other, including vertical-turret and polishing and buffing	....	851,386
Milling machines:		
Plain	135	359,515
Universal	120	294,569
Vertical	69	191,294
Other	139	489,902
Portable tools:		
Drills		
Electric		
Number reported	19,091	775,357
Number not reported	....	94,169
Pneumatic	5,024	633,488
Grinders		
Electric		
Number reported	5,968	200,541
Number not reported	....	60,025
Pneumatic	2,344	205,698
Hammers (chipping, riveting, calking, etc.)		
Electric	428	60,821
Pneumatic	10,824	568,456
Other, including portable motor-driven garage equipment and flexible-shaft machines	....	2,185,519
Presses (except forging presses):		
Forming		
Number reported	502	995,837
Number not reported	....	162,883
Stamping	†	271,083
Punch	†	81,886
Other	164	102,915
Shapers	32	56,922
Shears (power operated)	105	124,022
All other machine tools and machine tools not distributed by kind	....	3,143,522

*The figures for this item are not strictly comparable with those published in the 1931 report for the reason that they include data for boring machines made in 1933 by an establishment formerly classified in another industry.

†Data incomplete.

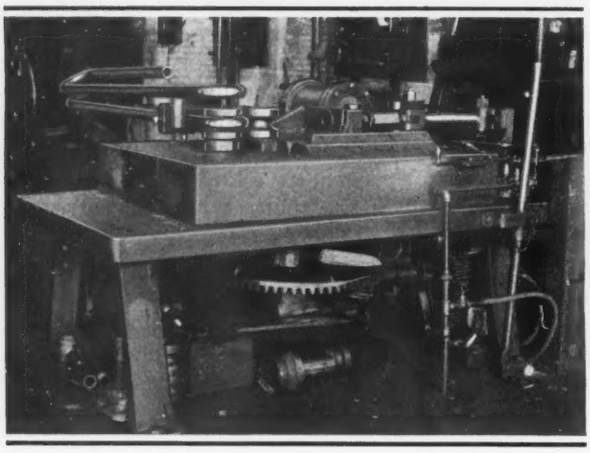


Fig. 1. Machine that Bends Full-weight Pipe to Short Radius without Flattening Outside of Bend

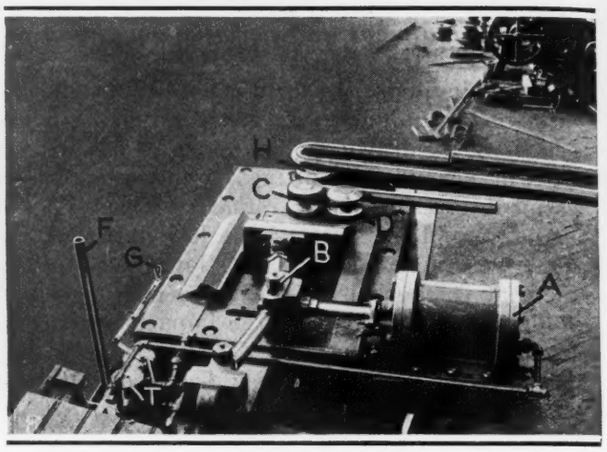


Fig. 2. Air Cylinder and Toggle Clamping Arrangement of Pipe-bending Machine Shown in Fig. 1

Machine for Bending Pipe Coils

By CHARLES C. TOMNEY

New Features of Design Enable Machine to Make Smooth, Short Radius Bends Without Requiring the Pipe to be Heated or Filled with Sand

BENDING full-weight 1 1/4-inch pipe to a radius of 2 3/8 inches and 2-inch pipe to a radius of 4 1/4 inches without flattening the pipe on the outside of the bend is something of an accomplishment when done with any type of bending equipment. The machine shown in Fig. 1 not only does this successfully, but performs the operation with the pipe cold and without having it filled with sand or other material.

The secret of the success obtained with this machine is found in the shape of the groove in the bending roll *C*, Fig. 2, and in the bending form *H*, Fig. 3, combined with the method of exerting pressure on the pipe by means of the air cylinder *A* and toggle *B*, Fig. 2. The shape of the groove in the bending form and in the bending roll is shown by the enlarged view at *S*, Fig. 3. The bore of the air cylinder is 7 inches in diameter and the operating pressure is 80 pounds per square inch.

The two three-way air valves *T*, Fig. 2, which control the operation of the air cylinder *A*, are connected with gears so timed that when one is opened

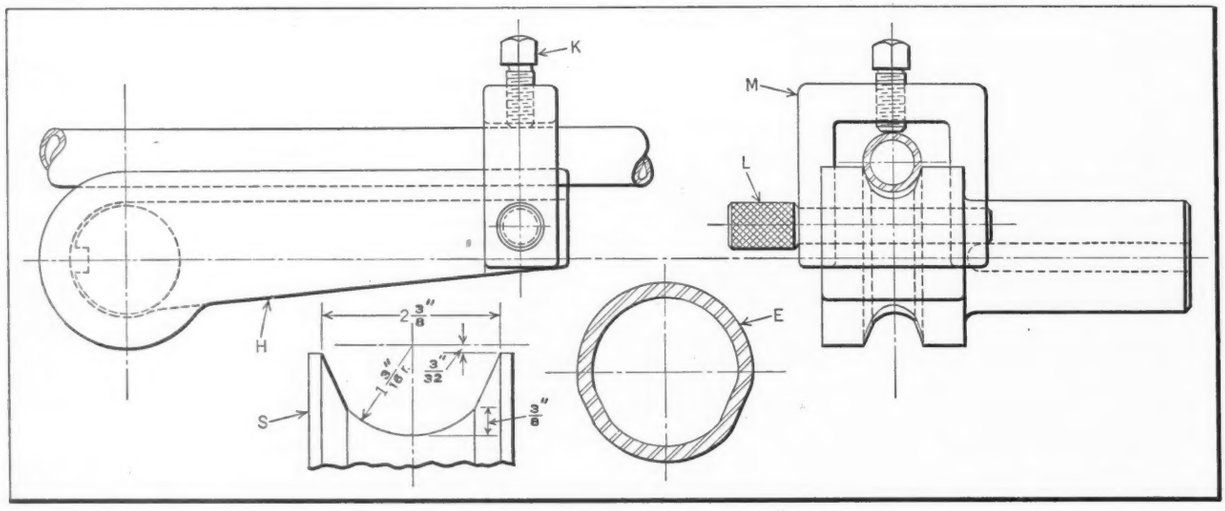


Fig. 3. Details of Groove-bending Form and Clamp Used on Machine Illustrated in Figs. 1 and 2

the other is closed automatically. The shape of the roll, as shown at *S*, Fig. 3, was arrived at by experiment. The first roll *C*, Fig. 2, on the slide has the same shape. The second roll *D* is used only as an idler for guiding the pipe. The pressure exerted by the air cylinder *A* and toggle *B* against the form squeezes the pipe so that it conforms to the shape of the roll at the beginning of the bend. After the bend is made, the inside is almost the same shape as the roll, but the outside returns to its original shape, as shown at *E*, Fig. 3, when the pipe is wrapped around the form.

The bending arm of the machine is driven by an open and crossed belt, using friction-clutch pulleys. The machine is started and stopped by means of the lever *F*, Fig. 2, and the air valves are operated by lever *G*. In starting a bend, the form *H*, Fig. 3, is in the opposite position from that shown in Fig. 2. After the bend is completed, as shown in Fig. 3, the set-screw *K* is loosened. The pin *L* and the clamp *M* are then removed and the air pressure released, so that the bent pipe can be withdrawn from the machine. The bending machine is now reversed and the bending form returned to its starting position.

The spindle turns at a speed of only five revolutions per minute which permits it to be easily controlled. Standard-length pipes are bent with the position of the bend for each loop determined by special gages, so that the ends will match properly when butt-welded together.

* * *

Finding Diameter of Cylinder from Measurement of Arc

By PAUL C. BRUHL

A method of finding the diameter of cylindrical work with the aid of a depth gage when considerably less than half the circumference is available for measurement is shown in the accompanying illustration. The device *A* was designed by the writer for use in this system of measuring. It is about 2 inches wide and has a hole in the top surface through which the spindle of the depth gage is inserted.

The device as designed will give accurate results when used for diameters from 4 to 8 inches. With less accuracy, it will measure diameters up to 16 inches, but it is advisable to make the gap *C* 8 inches wide for the larger diameters and to increase the other dimensions proportionately.

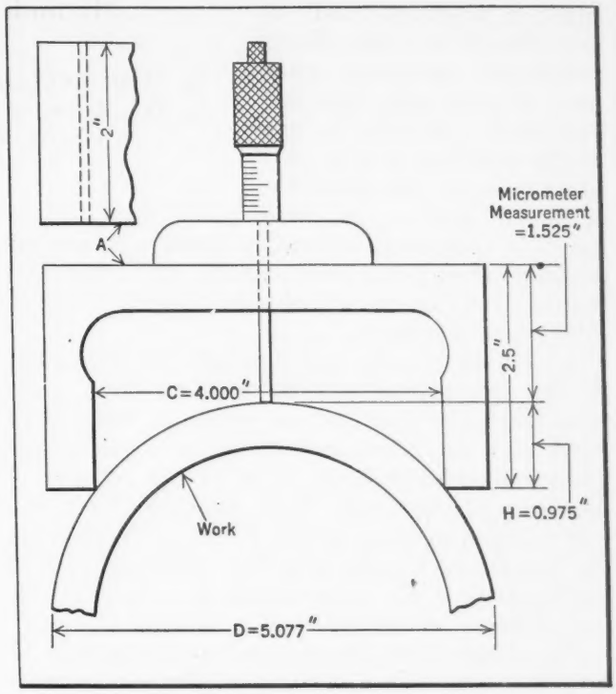
In use, the device is placed on the work to be measured in the position shown in the illustration, and the depth micrometer adjusted until its spindle just touches the work. The reading of the micrometer is taken to the third decimal and subtracted from the gage height, which is 2.500 inches, leaving the remainder *H*. The value *C* (4 inches) remains constant. Employing the formula, we have

$$D = \frac{(1/2\,C)^2 + H^2}{H}$$

in which D = the diameter of the work.

To illustrate the application of this formula, let us assume that the reading on the depth micrometer is 1.525, and that $H = 0.975$. The term $(1/2\,C)^2$ of the formula remains constant and is equal to 4. Substituting the numerical values in the formula, we have

$$D = \frac{4 + 0.975^2}{0.975} = 5.077 \text{ inches}$$



Method of Measuring Arc to Determine Diameter

Unique Setting for an Exhibit

The Revere Copper & Brass, Inc., has installed an exhibit of its products and of objects made from them, including copper utensils, giftware in copper and chromium, and sheets, rods, tubes, pipe, etc., in the Paul Revere house in the Colonial Village at the Century of Progress Exposition. The house itself is a reproduction of Paul Revere's house in North Square, Boston. The Revere exhibit occupies the living room of the house, which is a replica of the original. The exhibits are displayed in cabinets of the early American period, which are in keeping with the rest of the room, so that the ordinary commercial aspect is eliminated to a considerable degree.

The original wooden model of Paul Revere's first copper rolling mill is also shown. This mill was put into operation in 1802 and was the first copper rolling equipment in the United States. The present Revere Copper & Brass, Inc., traces its ancestry back to Paul Revere's original mill at Canton, Mass.

Reducing Power Losses Does Not Necessarily Reduce Costs

All the Cost Factors Should be Studied Before Making a Change in the Power Transmission Methods of a Plant

By ALFRED KULLMAN, Research Engineer
The Mechanical Power Engineering Associates, Worcester, Mass.

BEFORE any changes are effected in the power transmission system of a manufacturing plant, a thorough study of costs should be made. Every industrial operation must pass an economics examination to be justified, so long as the profit motive is part of the reason for industry. A small amount of time spent in computing operating costs will prevent decisions from being made, which, while they may reduce power losses, actually may result in higher total operating costs.

A striking example was brought out by a study of the power transmission problem in a plant manufacturing domestic gas stoves at the rate of forty an hour. Electric furnaces used for baking the porcelain enamel accounted for 86 per cent of the electric power used. The remaining 14 per cent was supplied to motors, 65 per cent of the mechanical load being unit-driven. The heavy unit-driven machines were air compressors for sand-blasting, frit grinders, conveyors, and a furnace blower.

This means that the motors driving groups of machines used only 5 per cent of the total electric power consumed in the plant. The group-driven machines, however, constituted eighty-nine out of a total of one hundred and sixteen machines. These eighty-nine machines were located in the brass and burner departments, the machine shop, and the power press department.

The group drives were antiquated. The shafts were up to 200 feet in length, wooden stringers were used, and the hanger bearings were of the ordinary ring-oiling type. The alignment of the shafting was difficult to maintain. The motor sizes were not well chosen for their requirements, so that there was a range of loading varying from 50 to 150 per cent of the ratings.

Tests on the groups showed mechanical losses averaging 30 per cent of the average operating load on the motors. It was proposed, therefore, to equip each machine with an individual motor to effect (consideration being given to an increase in electrical losses) a saving in power of 73,000 kilowatt-hours annually. At $0.01176 per kilowatt-hour, this would mean a saving of about $860 annually; but the power factor of the entire plant would be so adversely affected by the individual motors that the power bill would show a net reduction of only $296 annually. Obviously, the unit drives would increase the fixed charges and maintenance costs.

The entire investigation gave the results shown in the accompanying table. It will be noted that the total annual operating cost would increase $1490.64 which must be charged wholly to obtaining a neater appearance in the plant, since no other advantages would be gained, such as improved lighting or a reduction in the cost of relocating machines when changing production lines.

The logical move in this plant, therefore, was to modernize the present groups. By so doing, the efficiency could be raised above 82 per cent. A power factor could be obtained that is even better than the present one, and a reduction of $876 could be made in the annual power bill. In addition, $142 annually would be saved in reduced maintenance costs by anti-friction hanger bearings. All these savings could be accomplished by an in-

Actual Study of Comparative Power Transmission Costs

Items	Present Combination Group and Unit Drive	Unit Drive on Each Machine	Increase in Dollars Due to Unit Drive	Increase Cent Per
Total Installation Cost	$22,442.84	$33,351.82	$10,908.98	49
Total Annual Operating Cost..	$11,559.13	$13,049.77	$1,490.64	14
Annual Operating Cost:				
Fixed Charges (15 per cent)	$3,366 43	$5,002.77	$1,636.34	
Maintenance .	408.70	559.00	150.30	
Cost of Power to Motors	7,784.00	7,488.00	296.00*	
Number of Motors	32	116		
Total Connected Motor Horsepower	346	512		
Power Factor ..	0.803	0.710		
Efficiency, Per Cent	72.4	81.5		

*Decrease.

crease in the present installation cost of approximately $2000.

This case study demonstrates that it may be possible to save power by removing antiquated line-shaft drives and installing individual motors on each machine; yet one may not be able to justify such a move economically. A method of modernization is also pointed out which accomplishes both a saving in power and a reduction in total operating costs.

* * *

Giving Industry a Chance

The relaxation of restrictions on enterprise is largely a matter of getting rid of what might be described as "nuisance rules." One example is the absurdly complicated statement required under the Securities Act. Another is the hopelessly intricate effort to obtain "compliance" with NRA codes by looking for Blue Eagles throughout the myriad stages of industrial production. Things like these belong to the adolescent period of the New Deal. They are the products of hysteria, excessive zeal, ballyhoo, the first intoxication of power. They have no permanent place in it. The time has come to simplify, select, regularize, and consolidate, with the clear purpose of making the new order operate with the normal motives of average men.—*Walter Lippmann in the New York Herald Tribune*

* * *

Several references have been made in MACHINERY of late to records of long service. It is of interest to note that, of all the employes at the Packard automobile plant, over 70 per cent have been with the company five years or more, and nearly 30 per cent have been in the company's employ for ten years or more. In 1933, there were 277 men and women who had completed ten years of unbroken service with the Packard Motor Car Co.

Operating Heavy Forge Hammer at the Chicago World's Fair

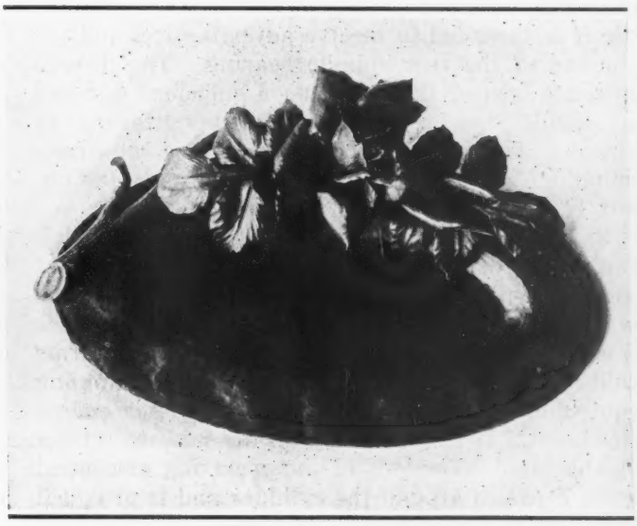
Marking the one-hundredth anniversary of the invention of the steam hammer, the Chrysler Corporation recently put into operation at the Chicago World's Fair a 4000-pound steam drop-forge hammer made by the Erie Foundry Co., Erie, Pa. This hammer, weighing more than 60 tons, performs the only forging operation on the Fair grounds, and at the same time makes one of the most intricate of forgings—a steering knuckle. The steering knuckles are forged from billets at the rate of one a minute. The finished product is then shipped to Detroit for machining and assembly into automobiles.

It is of interest to note that when the hammer strikes the bottom die, it does so with a force equal to that with which a 2000-pound automobile traveling at 40 miles an hour would strike an object. In spite of this power, the control is so sensitive that it is possible to crack a walnut with this giant hammer without crushing the meat. The hammer will be in operation daily for the remainder of the Fair.

* * *

Safety Treads for Stairs

A "non-slip" tread for stairs, known as Alundum rubber-bonded safety tread, made by the Norton Co., Worcester, Mass., and available in three colors —red, green, and buff—has become very popular for stairways where a non-slip feature is desired. One of the advantages is that the non-slip feature is permanent—the treads will not wear smooth. Furthermore, the treads have a perfectly flat surface, so that there is nothing to catch heels or cause a tripping hazard; nor are they affected by weather conditions. It is pointed out that the non-slip effectiveness of these treads is not lessened by water, so that they are suitable for use outdoors as well as indoors.



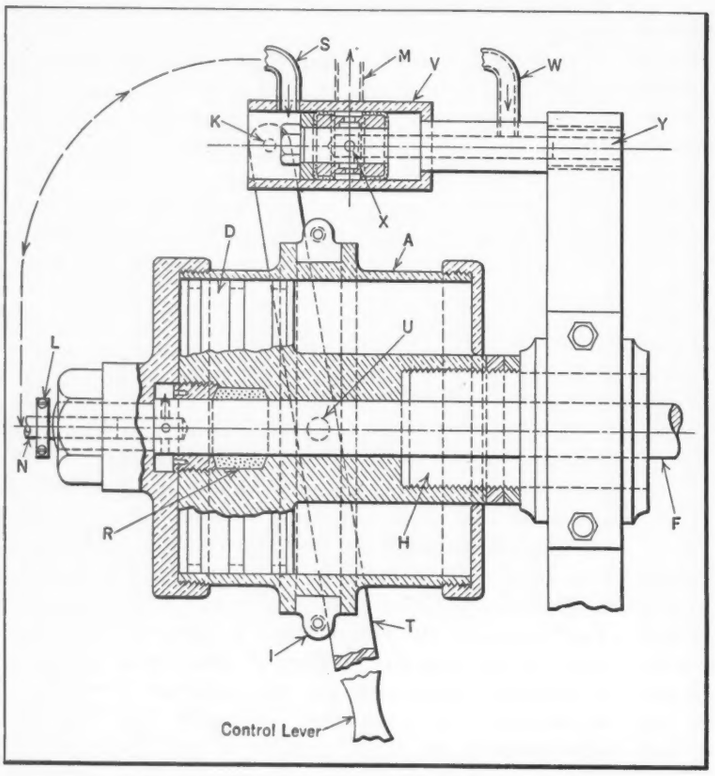
Twenty-five years ago the name of James Cran was familiar to readers of MACHINERY as the author of a series of articles on blacksmithing and forging. The readers of those years will also remember some of the samples of artistic blacksmithing shown on several occasions in MACHINERY'S pages. The accompanying illustration indicates that Mr. Cran has not lost his artistic ability in shaping roses, leaves, and branches from bars of Swedish iron. The ash tray shown is about 8 inches long, and the entire object was produced with the assistance of no other equipment than a hammer, chisel, tongs, and a blacksmith's forge.

Air Cylinder for Operating Long-Stroke Draw-in Rod

By STANLEY EDWARDS

The air cylinder and control valve shown in the accompanying illustration were designed to operate a draw-in rod in the spindle of a standard type production lathe. The draw-in rod was required to have a longer stroke than could be obtained with the regular type rod operated by a hand-lever.

The cast-bronze cylinder *A* is bored to fit piston *D* which has three step-cut rings. The lathe spindle *H* is threaded to receive adjusting lock-nuts at the end of the rear spindle bearing. This thread projects beyond the lock-nuts a sufficient distance to enable the bronze piston to be attached as shown. The piston is bored to receive the draw-spindle *F*, and is also provided with a stuffing-box *R*.



Air Cylinder and Control Valve Used to Actuate Long-stroke Draw-in Rod in Production Lathe Spindle

Spindle *F* is secured to the cylinder head with a nut, and is drilled and provided with a stuffing-box (not shown) for the brass tube *N*, which is held stationary by a clamp *L* secured to the floor. The inner end of spindle *F* is threaded to fit the draw collar spindle that carries such work-clamping equipment as may be required. The outer end of the tube *N* is connected by an air hose to tube *S* on the valve. The loop of the operating or control lever *T* passes around the cylinder and is provided with trunnions *U* that fit into the collar *I* in which the air cylinder rotates. It will be noted that both the cylinder and piston rotate with the lathe spindle.

The stud that supports the operating valve has drilled outlet holes at *X*, the center hole being plugged at *Y*. A tube *W*, connected to the air supply line, leads to the center hole in the stud. The stud also carries two cup-shaped leather seals and a spacing collar which is counterbored, recessed, and drilled to permit the air to be discharged into tube *S* when the valve is operated. The sleeve *V* consists of a bronze casting, bored to receive the valve cup leathers, stud, etc. It is also provided with a stud *K*, to which the control lever is attached.

When the operator moves the control lever to the left, the sleeve *V* moves to the right, so that tube *S* is in the position indicated by the dotted lines *M*. This admits air to the cylinder counterbore through the hose connected at *N*, causing the cylinder to draw the spindle outward. The lever *T* is also carried outward with the cylinder by this movement. To release the clamping pressure, the operator moves the handle of the control lever toward the right, so that the valve sleeve *V* is in the position shown in the illustration. Air is thus allowed to exhaust into the atmosphere through tube *S*. Continued movement of the control lever toward the right serves to return the cylinder to the position shown in the illustration. This equipment has proved very efficient and easy to operate.

* * *

A Nation Can Have No More Than it Produces

A booklet entitled "Private Initiative vs. Planned Economy," prepared by Allen W. Rucker in collaboration with N. W. Pickering, president of the Farrel Birmingham Co., Inc., Ansonia, Conn., very ably deals with the subject of reduced working hours and the effect of improved processes and production equipment on purchasing power. In the booklet, a section is devoted to factors that retard recovery, and the fact is emphasized that, in the long run, employment is not increased by shorter working hours, but only by increased production. Says the author: "Contrary to much inexperienced opinion, technological progress is not primarily sought in order to increase aggregate production nor to curtail employment, but to increase *productivity per worker*, keep down prices, and thus permit active trade, greater production, and employment. A nation can have no more than it produces." This last sentence is one that Washington officials should ponder.

Automatic Feed for Tank-Head Circling and Flanging Machine

By JOSEPH C. COYLE

Production of the circling machine shown in Figs. 1 and 2 was increased 30 per cent by the addition of a simple, inexpensive power feed. This feed made the machine practically automatic in operation. After placing the work in position, the operator simply engages the automatic feed by means of the lever shown at *R*, Fig. 1.

The equipment comprising the automatic feed consists of a 6-inch pulley attached to the rear end of the drive shaft of the circling machine and a 14-inch pulley *A* mounted near the upper gear of the machine. The bearing for this pulley is securely fastened to the frame. A V-belt drive between these two pulleys transmits power from the main shaft, by means of a universal joint *B*, to a secondary shaft *C* leading to the worm drive *D*, which is enclosed, except where engagement is made with the feed post *F* of the machine. The worm housing is welded to a plate *E*, attached to the machine frame by two studs. This mechanism serves to drive the feed post *F* when thrown into gear by lever *R*.

A clutch lever extending the length of the machine is attached to the crank-shaped shaft at the rear, which is commonly used to trip the machine when changing the work. A small weight is attached to the crank-arm to which this clutch lever is secured to aid the automatic tripping device. To the crank-arm *G*, Fig. 2, of the shaft *N*, on the opposite side of the machine, is attached a rod *H* with a flat bar *I* at the lower end, in which there is a 3/4-inch slot 6 inches long. A bolt at the extremity of the clutch arm extends through the slot in bar *I*. The bolt slides in this slot when the clutch is tripped.

To the upper end of rod *H* is connected a lever *K* which is held to the machine by stud *L*. At the lower end *M* of this lever is a bolt which extends under the arm of the machine. On the back end of this bolt is a pin extending upward and another pin extending downward at right angles to the bolt. The lengths to which these pins are adjusted regulate the point at which the machine is tripped.

The tripping action is accomplished when the post, in moving down, strikes the pin in the bolt. This moves the lever *K*, which exerts a pull on the rod *H*, thus causing the weight on the crank-arm at the opposite end of the crankshaft *N* to act in such a manner that it trips the clutch.

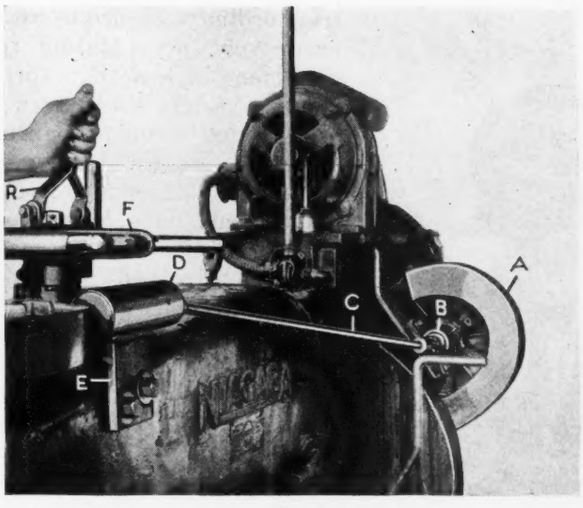


Fig. 1. Front View of Circling Machine, Showing Method of Attaching Worm Drive

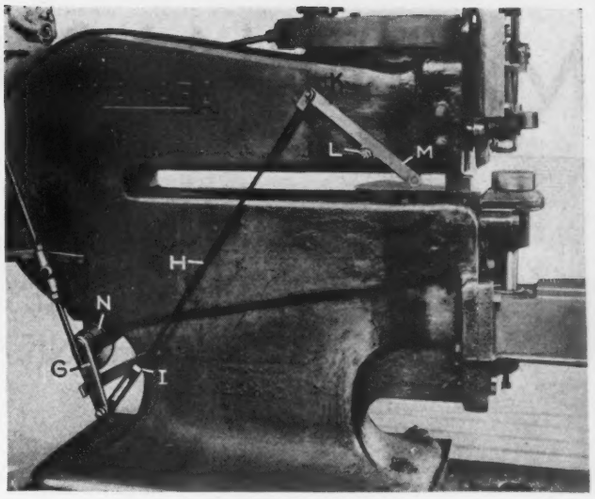


Fig. 2. Rear View of Circling Machine, Showing Tripping Mechanism

* * *

Air Delivery Saves Tie-Up of 150 Men and 35 Trucks

Within an hour of the day's closing time, the engine of a cement machine broke down on a construction job near Salt Lake City. Unless immediate repairs could be effected, 150 men and 35 trucks would be idle. The manufacturers of the equipment in San Francisco were called by telephone, and the required parts left by railway express plane for Salt Lake City at 11 P.M., arriving there after a 700-mile flight at 4 o'clock in the morning. As a result, the repairs were completed before resumption of work at 8 o'clock the same morning.

* * *

The real trouble with the world today is that the activities, methods, and practices of the rest of the community have not been adjusted to keep step with the advance in engineering. Broadly speaking, our governmental and fiscal methods, our finance and economics, our legal conceptions, and many of our educational ideas are of the eighteenth century; engineering and medicine only are of the twentieth.

MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Crinkled Aluminum Foil Insulates the "Zephyr"

The walls and roofs of the cars that make up the stainless-steel *Zephyr*—the pride of the Burlington Lines since this train made its run from Denver to Chicago, a distance of over 1000 miles at an average speed of more than seventy-six miles an hour—are insulated throughout with Alfol. This material, a product of the Alfol Insulation Co., New York, is made up of several sheets of crinkled aluminum foil. It weighs only about 1/4 ounce per foot, board measure. Alfol combines low conductivity with low-convection air spaces and high reflectivity.

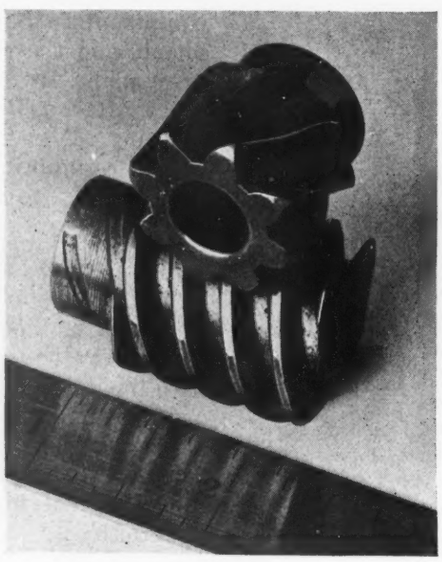
Advantages of Beryllium Copper Increasingly Utilized

The possibility of greatly increasing the tensile strength and other physical properties of copper parts through heat-treatment constantly leads to wider application of beryllium copper. A sheet of this alloy 0.040 inch thick has a tensile strength of 74,000 pounds per square inch, even in the fully annealed condition. By heat-treating the same sheet for one hour at 570 degrees F., the tensile strength can be increased to over 174,000 pounds per square inch. If an annealed 0.040-inch sheet is rolled to reduce the thickness four B & S gage numbers, the tensile strength will be 118,000 pounds per square inch. By heat-treatment, the tensile strength of this rolled sheet can be increased to more than 195,000 pounds per square inch.

Tensile strengths intermediate between the minimum and maximum values mentioned can be obtained by less rolling and shorter heat-treatment. An elastic limit is obtainable all the way from 23,000 to 148,000 pounds per square inch. The elongation ranges from 48 down to 2 per cent in 2 inches.

Beryllium copper is being used considerably for electrical contact springs in snap switches and electrical instruments. This alloy is especially suitable for such service because of its resiliency, its high resistance to fatigue, and its resistance to the softening effect of temperatures up to 350 degrees F. Other applications of the alloy in the electrical field are pins and plugs of various household appliances, circuit-breaker parts, brush-holder springs, and relay parts. Such pieces can be produced from strip stock in the punch press and then heat-treated to obtain higher physical qualities.

The illustration shows a worm-gear of approximately 3/4 inch pitch diameter, which runs in mesh with a steel worm in the drive of a sewing machine. The gear runs at a speed of 2000 revolutions per minute. This high speed, in combination with the small size of the gear, causes gears made from ordinary bronze to wear excessively, necessitating replacement in less than three months. Gears made from a heat-treated wrought bar of beryllium copper having a hardness of 42 on the Rockwell C-scale have been used in this application for over three months and no wear can be detected.



The Gear in This Small Worm Drive is Made of Beryllium Copper to Withstand Severe Service

In the machinery field, bearings made of beryllium copper have proved unusually satisfactory. This alloy is also being used by one concern in place of cast iron for barrel cams that formerly broke with frequency and tied up the operation of heavy-

duty production machines. In this instance, beryllium copper is cast to the approximate shape of the cams. Cast beryllium copper is also being used for the sleeves of adjustable-pitch airplane propellers and for propeller hub cones. A concern in the machine tool field proposes to use beryllium copper for the jaw adjusting nut of lathe chucks.

In the field of resistance welding, one company uses beryllium copper, because of its hardness and good electrical conductivity, for die inserts to withstand the wear that usually occurs. These inserts can be readily brazed or silver soldered in the steel dies. The success of beryllium copper in this application has led to experiments with welding dies forged completely from the alloy.

Of considerable interest to the users of hand tools under conditions where corrosion of steel tools is likely to take place or where explosions may occur from sparks flying off steel tools is a line of beryllium-copper hammers, chisels, screwdrivers, scrapers, etc., being manufactured by a prominent New England concern. Chisels of this kind have sheared off the heads of 1/4-inch steel rivets and performed similar service without any damage to their edges.

Rubber Becomes an Important Material for Street Cars

Steel wheels cushioned with rings of rubber are a feature of a noiseless street car recently built by the J. G. Brill Co., Philadelphia, Pa. Each of these wheels includes two steel tires which are assembled side by side with four of the rubber cushioning rings between them. The construction is said to give somewhat the same riding qualities as an automobile tire, with increased smoothness, due to the fact that the steel rails on which electric cars run are smoother than ordinary street pavement. Each wheel will carry a load of 7000 pounds, which means a total possible load for the car of 56,000 pounds, although the fully loaded car weighs only 45,000 pounds.

In addition to these rubber-cushioned wheels, there are fifty-five individual parts made of rubber to prevent the development of the rattles, clatter, and other objectionable noises usually associated with street cars. It is claimed that except for the much deadened clicking of the steel tires striking the rail joints, the car is practically noiseless and cannot be heard above other street traffic. The spring suspension has been insulated with rubber to eliminate friction. This feature further enhances the comfort of riding. All of these rubber parts were made by the Firestone Tire & Rubber Co.

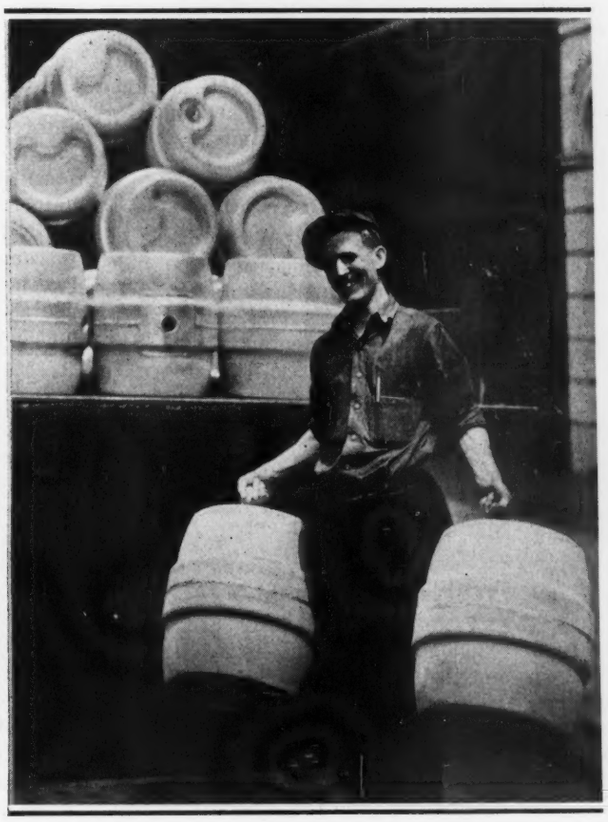
Much has been said about the use of aluminum in the construction of the Union Pacific streamline trains, but rubber has been an important adjunct to that metal. For example, the vestibule covers between the cars are made of pure gum rubber. The passageways are smoothly covered by the rubber so as to reduce the air resistance.

Another Train Being Built of Stainless Steel

The striking performance of the streamline stainless-steel trains recently built by the Edward G. Budd Mfg. Co., Philadelphia, Pa., has led to an order from the Boston & Maine Railroad for a train of the same material. This train will cut nearly one-third off the running time of the fastest express between Bangor, Me., and Boston, Mass. It will replace two ordinary steam trains and cover a greater daily mileage than any railroad train in equal running time on regular service.

Leaving Portland early in the morning, the train will make a quick run over the 115 miles to Boston, then head north again through Portland to Bangor, a distance of 250 miles, return to Boston in the late afternoon and again double back to Portland in the evening, a total distance of 730 miles.

This train will consist of three stainless-steel cars, fabricated into one piece by the shot-weld process.



Two Beer Barrels Carried with Two Fingers. This is not a Strongman Act, Since the Barrels are Made of Aluminum and Weigh Only 18 1/2 Pounds Apiece

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Stainless Steel

INGERSOLL STEEL & DISC CO. (Division of the Borg-Warner Corporation), 310 S. Michigan Ave., Chicago, Ill. Manual of welding and fabricating procedures for IngAclad stainless clad steel. This book describes step by step the methods of welding, lock-seaming, riveting, deep drawing, heat-treating, pickling, etc., of stainless clad steel, and gives specific suggestions for machining and fabricating this material. An illustrated section of the book shows actual installations and applications of IngAclad in a wide range of industries.

Electrical Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Booklet GES 1012, entitled "Here's Proof that Power Factor Improvement Reduces Power Costs," describing briefly a few of the many cases where the installation of G-E power factor improvement equipment has improved plant operation and effected savings. Actual figures are given in each case.

Bulletin GEA 1979, illustrating and describing G-E reduced-voltage starters of the auto-transformer type for squirrel-cage induction motors.

Pyrometers

ILLINOIS TESTING LABORATORIES, INC., 141 W. Austin Ave., Chicago, Ill. Bulletin 1726, illustrating and describing the Alnor Pyroll pyrometer for measuring surface temperatures of revolving rolls or dryers. Bulletin 1727, covering the Alnor Pyrocon combination pyrometer and the Type 1755 pyrometer for measuring surface temperatures of flat surfaces as, for example, on molds, dies, platens, plates, etc., either metallic or non-metallic.

Portable Compressors

INGERSOLL-RAND CO., 11 Broadway, New York City. Bulletin entitled "A Better Portable Compressor," outlining the advantages of the Ingersoll-Rand two-stage air-cooled portable compressor. Both the oil-engine and the gasoline-engine driven units are shown in the bulletin, and details are given as to the amount of fuel savings that can be expected, as compared with single-stage water-cooled compressors.

Electric Measuring and Controlling Instruments

ROLLER-SMITH CO., 233 Broadway, New York City. Price Sheet 7 for catalogue 123, containing data on the new Roller-Smith line of portable measuring instruments known as Type NPD for direct current and Type NPA for alternating current.

Catalogue 10, illustrating and describing the new Kathetron outvoltage regulator, which is designed to eliminate light flicker in electrically operated equipment.

Tool and Cutter Grinders

LANDIS TOOL CO., Waynesboro, Pa. Catalogue 034, illustrating and describing in detail the Landis 12- by 32-inch tool and cutter grinder with universal attachments. Typical setups of the machine are shown to illustrate the use of the various attachments, and descriptions are included of the circular forming tool grinding equipment, radial grinding attachment, and the spiral generating grinding equipment.

Welding Equipment

LINDE AIR PRODUCTS CO., 30 E. 42nd St., New York City. Booklet entitled "The Testing and Qualification of Welders," outlining simple tests for measuring the ability of welders. The book has sections on the fracture test, the bend test, the tensile test, and the observation test. It also gives a summary of existing and pending qualification tests for welding steel plate and pipe.

Weighing Equipment

FAIRBANKS, MORSE & CO., Chicago, Ill., manufacturers of weighing equipment, engines, motors, fans, pumps, farm power equipment, railroad equipment, etc., are distributing an anniversary number of the *F-M News*, celebrating "more than a century of progress." The book tells the story of the growth and development of the company from its inception in 1830.

Silent Gear Material

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Bulletin entitled "Micarta—The Silent Lasting Gear Material." The bulletin describes the characteristics of this material and methods of machining, as well as the performance of Micarta gears. It also contains tables of physical properties, horsepower ratings, etc.

Flexible Couplings

MORSE CHAIN CO., Division of Borg-Warner Corporation, Ithaca, N. Y. Bulletin 48, describing the features of construction of the Morse "Morflex" coupling, which was originally developed as a universal joint to compensate for misalignment between shafts, but is now suitable for use as an all-purpose coupling. Dimensions and list prices are included.

Steel

FIRTH-STERLING STEEL CO., McKeesport, Pa. Circular outlining the characteristics, uses, analysis, and heat-treatment of "Special A.S.V." steel, which is produced by the Firth winged ingot method of casting.

Bulletin giving analysis, physical characteristics, heat-treatment, and uses of J-S chisel and punch steel.

Electrical Equipment

SWITCH AND PANEL DIVISION OF THE SQUARE D CO., Detroit, Mich., is issuing new catalogue pages for

its loose-leaf catalogue No. 37, which will bring the catalogue completely up to date. The data includes prices and descriptions of a complete line of switches, fuse cabinet and switch combinations, circuit-breakers, switchboards, Rectifilters, etc.

Swaging Machines

TORRINGTON CO., 55 Field St., Torrington, Conn. Catalogue illustrating and describing the Torrington swaging machine. In addition to specifications of the various sizes, information is given on the care and operation of the machine, and a number of typical examples of swaging are shown, including both solid and tubular work.

Portable Flexible Shaft Machinery

R. G. HASKINS CO., 4634 W. Fulton St., Chicago, Ill. Catalogue 43, containing data on Haskins flexible shaft equipment, tools, and accessories, including die and mold grinders; light-duty grinders for patternmakers; toolpost grinders; polishing and sanding equipment; heavy-duty grinders; high-speed tapping equipment, etc.

Packings

JOHNS-MANVILLE, 22 E. 40th St., New York City. Catalogue covering the complete line of packings made by this concern. Over sixty different types of packings are described and illustrated. A table showing the type of packing best suited for each requirement is included, and information is given on methods of installing.

Furnace Controlling Equipment

LEEDS & NORTHRUP CO., 4901 Stenton Ave., Philadelphia, Pa. Bulletin 842, describing the Leeds & Northrup automatic furnace pressure control for metallurgical and other industrial furnaces. The bulletin contains a complete description of the design, construction, and maintenance costs of this equipment.

Precision Bench Lathes

HARDINGE BROS., INC., Elmira, N. Y. Circular describing the distinctive features of the Cataract enclosed-head precision bench lathes, which are designed to give ease of operation and to eliminate moving belts above the bench. Specifications are given for the various sizes in which this machine is made.

Carboloy Products

HENRY DISSTON & SONS, INC., 855 Tacony, Philadelphia, Pa. Pamphlet on the selection and care of Disston Carboloy fitted saws and tools. One of the useful features of the book is a table that shows the type saw, number of teeth, and speed required for cutting various materials with Carboloy fitted saws.

Belt Conveyors

WICKWIRE SPENCER STEEL CO., 41 E. 42nd St., New York City. Metal Conveyor Belt Handbook, containing information on the Wissco conveyor belts and their uses. The book describes the different types of belts that are made and gives tables of weaving limits and weights per square foot.

V-Belting

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J. Engineering data book containing the latest list prices on Condor V-belts, as well as engineering information, including chapters on selecting a V-belt drive and the design of special V-belt drives.

Dust Collectors and Blast Cleaning Equipment

PANGBORN CORPORATION, Hagerstown, Md. Bulletin 197, describing the fourteen outstanding features of the Pangborn Type CH all-metal cloth-screen dust collector. Circular on Pangborn blast cleaning equipment, outlining the advantages and giving a partial list of users.

Tube Couplings and Tube Fabricating Equipment

PARKER APPLIANCE CO., Cleveland, Ohio. Bulletin 37, on Parker tube couplings and associated equipment. Complete specifications are given, including list prices.

Bulletin 28, descriptive of Parker tube fabricating equipment.

Heat-Treating Equipment

LEEDS & NORTHRUP CO., 4901 Stenton Ave., Philadelphia, Pa. Bulletin 950, descriptive of the Homo method of nitriding steel. Bulletin L-940, descriptive of a Homo tempering furnace specialized for high production and extra dense loads.

Leather Belting

E. F. HOUGHTON & CO., 240 W. Somerset St., Philadelphia, Pa. Booklet on "Vim Tred" leather belting, a belt designed with a "non-skid" surface. The advantages of this type of belting and its performance in actual service are described.

Valves

JENKINS BROS., 80 White St., New York City. Circular on Jenkins standard iron body gate valves. The circular is made in the form of a cut-out which is an exact reproduction of both the exterior and the mechanism of this valve.

Power Squaring Shears

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Bulletin 71-E, illustrating and describing the Niagara line of power squaring shears, with capacities for No. 14 gage soft steel and lighter.

Speed Reducers and Gears

D. O. JAMES MFG. CO., 1120 W. Monroe St., Chicago, Ill. Circular illustrating typical examples of the line of gears manufactured by this company, which includes spur, bevel, worm, internal, and herringbone gears.

Transmission Equipment

T. B. WOOD'S SONS CO., Chambersburg, Pa. Bulletin 270, describing the outstanding advantages and applications of the U.G. automatic belt contactor, which is designed to increase belt traction and reduce floor space.

Electric Motors and Generators

IMPERIAL ELECTRIC CO., Akron, Ohio. Bulletin 1040, entitled "Why You Should Buy from the Little Fellow," outlining many reasons why the small manufacturer is able to render a distinctive type of service.

Cold-Drawn Steels

UNION DRAWN STEEL CO., Massillon, Ohio. Circular entitled "Cold Work as a Substitute for Heat-Treatment," discussing the cold-drawing process and its advantages for certain classes of work.

Flexible Couplings

SMITH POWER TRANSMISSION CO., Penton Bldg., Cleveland, Ohio. Folder S-114, illustrating various applications of the Flexoid industrial couplings. Complete specifications, including list prices, are given.

Electric Burners

GENERAL ELECTRIC CO., Schenectady, N. Y. Leaflet GEA-1913, descriptive of the G-E Pyrotip electric burner for cutting, welding, burning, melting, soldering, and other industrial applications.

Cranes

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill. Illustrated 16-page catalogue No. 1595, covering locomotive cranes for operation by either gasoline, Diesel, electric, or steam power units.

Chain Hoists

YALE & TOWNE MFG. CO., 4530 Tacony St., Philadelphia, Pa. Circular illustrating a number of applications of Yale ball-bearing spur-geared, screw-geared, and differential chain hoists.

Diesel Engines

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin S-500-B6C, descriptive of Worthington vertical four-cycle direct injection Diesel engines.

Centrifugal Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin W-321-B2, illustrating and describing Worthington monobloc single-stage centrifugal pumps.

Core Drills

INGERSOLL-RAND CO., 11 Broadway, New York City. Bulletin 2096, covering the Calyx core drill, a drill for boring small or large cores for exploration or other purposes.

Tumbling Mills

W. W. SLY MFG. CO., 4700 Train Ave., Cleveland, Ohio. Bulletin S-75, illustrating various examples of Sly tumbling mills and listing the advantages of their design.

Material-Handling Equipment

MERCURY MFG. CO., 4118 S. Halsted St., Chicago, Ill. Bulletin 160, describing the Mercury trackless train, a tractor-trailer equipment.

Welding Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Leaflet 20619, describing electronic contactor timers for spot welding.

Improved Conditions Reported in Industry

The motor vehicle production for the first six months of 1934 was 1,802,442 units, an increase of 75 per cent over the corresponding period last year, according to the National Automobile Chamber of Commerce. The June output was approximately 328,000, an increase of 27 per cent over June last year. Furthermore, the output in June this year was only 7 per cent below the May output, a comparatively slight seasonal drop.

Sales billed by the General Electric Co. during the first six months of 1934 amounted to nearly $81,000,000, as compared with less than $62,000,000 for the corresponding period last year, an increase of 31 per cent. The orders received during the second quarter of 1934 amounted to $54,000,000, compared with $35,500,000 for the second quarter in 1933, an increase of 52 per cent. The increase in orders received for the first six months of the year amounted to 51 per cent. The second quarter in 1934 was the largest since the third quarter of 1931.

The Westinghouse Electric & Mfg. Co. has received an order amounting to more than $1,700,000 from the U. S. Navy Department. This order calls for furnishing the main propelling equipment for seven new United States Coast Guard cutters.

An order for approximately $120,000 has been obtained by the Westinghouse Electric & Mfg. Co. for equipment to electrify one of the mills of the American Boxboard Co., Grand Rapids, Mich. It is estimated that this modernization will pay for itself out of savings in about three years, since annual savings of about $45,000 are expected, following the replacement of the old equipment with new. The company has also received, from the Mesta Machine Co., the largest single order for steel-mill electrical equipment since 1929. This order amounts to nearly $1,000,000. The equipment will be installed on a 76-inch strip mill being built for the Youngstown Sheet & Tube Co.

The Duriron Co. of Dayton, Ohio, has started construction of an extension to its alloy-steel foundry which just doubles the size of the present plant. The addition to the plant is necessitated by the increased alloy-steel business.

The Kelvinator Corporation reports that, during the nine months ending June 30, the company shipped 32 per cent more electric refrigerators than during the corresponding nine months a year ago.

* * *

Standards Association Increases Membership

Despite the depression, the American Standards Association has been able to increase its membership so that at present it is larger than ever before. The Association now includes 42 member bodies and associate members, and 1233 company members. Since January, nine associations have become member bodies or associate members.

A Power Clutch with Sensitive Control

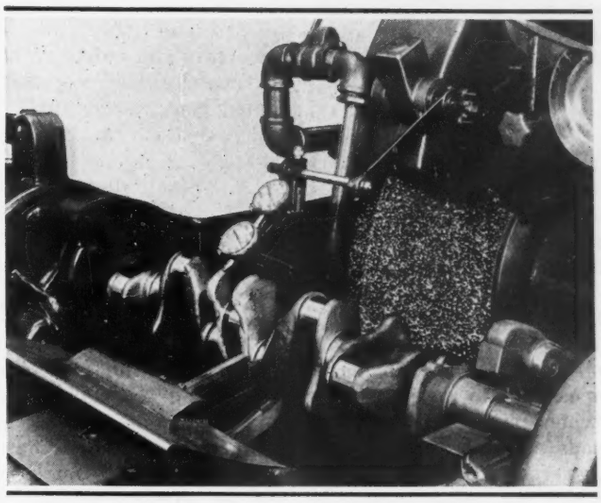
A new type of power clutch, known as the "Sure Feel" clutch, has been developed by the Harnischfeger Corporation, Milwaukee, Wis. The new clutch is particularly applicable for use on power excavators and cranes. It is advantageously used on cranes for hoisting steel beams on construction jobs, etc. The control is such that the heaviest crane loads can be handled easily and safely; and when used on excavators, if a big rock is struck, it requires only a fraction of a second to release the power and prevent serious damage.

* * *

It is idle to say that we have surplus producing capacity. This may be apparently so; but it is only because we have concentrated production on the few needs and luxuries that have been intensely exploited to date. There are many other needs and luxuries that we know of now, and many, many others that the future will develop, which may serve to fully occupy the productive capacity of the country, if it were properly diversified, and which, if this were done, would result in a far higher standard of living than that we now enjoy. Even with this greatly increased production, automatic control of machinery may materially reduce the working hours of man; but in regard to hours of work, let us not forget that too much leisure is as bad as too much work. — *W. L. Waters in Mechanical Engineering*

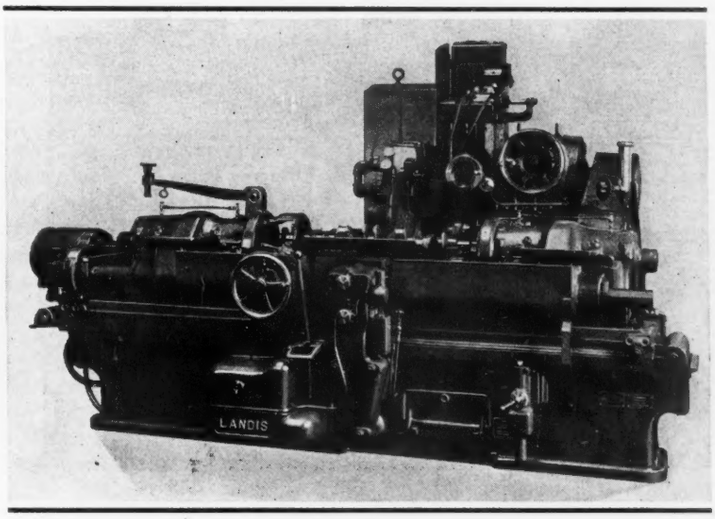
Shop Equipment News

Machine Tools, Unit Mechanisms Machine Parts and Material-Handling Appliances Recently Placed on the Market



Landis Hydraulic Crankpin Grinder

Nine years ago, the Landis Tool Co., Waynesboro, Pa., placed on the market a hydraulically operated machine designed for grinding all the pins of any crankshaft with but one handling of the work. The knowledge gained from experience since that time has led to the development of the Type D machine here illustrated, in which a number of improvements are incorporated. This latest design is also based on the principle of grinding all the pins of a crankshaft in one machine. Important advantages are obtained by attaching the work-rest to the front of the bed and coordinating the work-rest jaw movements with the wheel feed, the table traverse, and the clamping, radial-locating, and longitudinal-spacing mechanisms.



Latest Design of Landis Crankpin Grinding Machine which Grinds All Pins with One Handling of the Work

The machine has been designed throughout to permit rapid stock removal without setting up vibration and to enable crankshafts to be ground to even higher degrees of accuracy and finish than before. The bed is of much heavier construction than formerly and the work-table and wheel-head guides have been proportioned and spaced to give adequate support to the sliding units. The crank-head spindles and bearings are larger. The wheel-drive motor is mounted on the rear of the wheel-head and drives the wheel-spindle at the end by means of multiple V-belts. The wheel-spindle is unusually large, and is supported by long babbitt-lined steel bearings. In addition to the hydraulic work-rest being bolted to the front of the bed, the base is bridged over the work-table and bolted to the bed below and in front of the grinding wheel.

The controls have been arranged to facilitate operation of the machine. The main control lever has a number of functions.

As it is shifted from one position to another, it (1) clamps the work, (2) starts the work rotation, (3) advances the work-rest shoes, (4) withdraws the work-rest shoes, (5) disengages the spacing bar plunger, (6) traverses the work-table either to the right or to the left, and (7) releases the spacing bar plunger. Another lever to the left of the main control lever is used to unclamp the work. With this centralization of controls, much time and effort of the operator are saved.

Safety features have been provided to protect the machine and the operator. There is a mechanical interlock in the main control mechanism which makes it impossible to traverse the table when grinding or to rotate the heads when the wheel is being traversed in truing. The heads will not rotate when the work is unclamped or during traversal of the work-table, and the work-table cannot be traversed as long as the work-rest shoes are in the operative position. If, for any reason, the pressure in the hydraulic system drops, the rotation of the work will stop automatically.

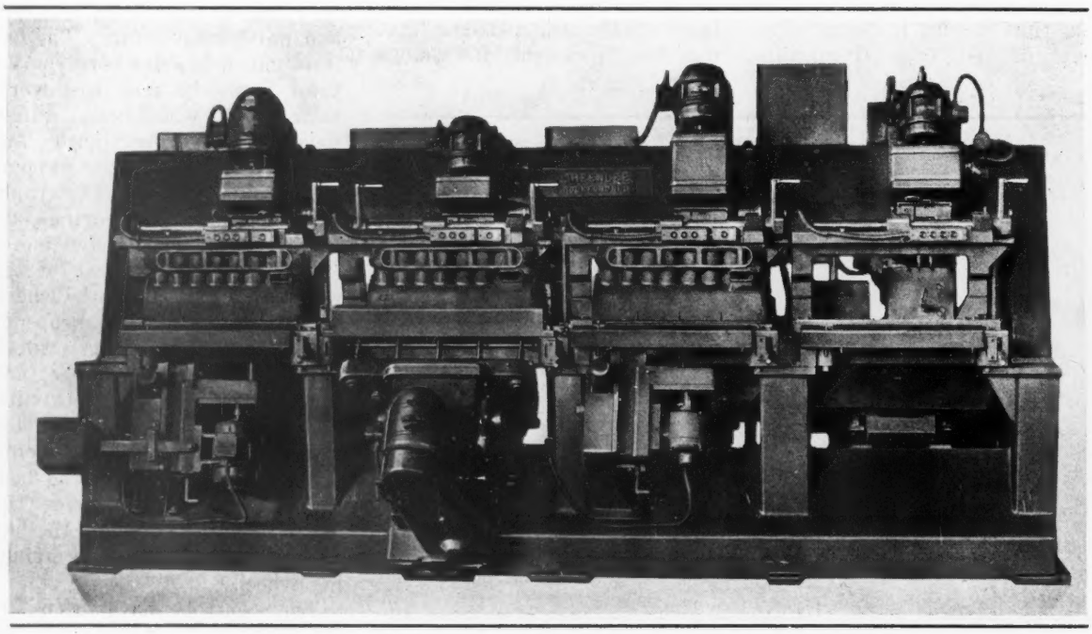
Hydraulic power is employed to traverse the work-table, feed the grinding wheel, operate the work clamps and spacing-bar plunger, and move the work-rest shoes. This gives these movements a wide range of adjustment, and they are effected smoothly and quietly. The work-carriage guides are flood-lubricated continuously with filtered oil supplied by the hydraulic system.

A 36-inch diameter grinding wheel is considered standard, although a 42-inch wheel machine can be supplied. A wheel dresser can be built into the top of the grinding-wheel fender, the dressing wheel being hydraulically driven. When this equipment is supplied, the dresser wheel is always set up and the work need not be removed for truing. This crankpin grinding machine is being built in two sizes—16 by 32 inches and 16 by 42 inches.

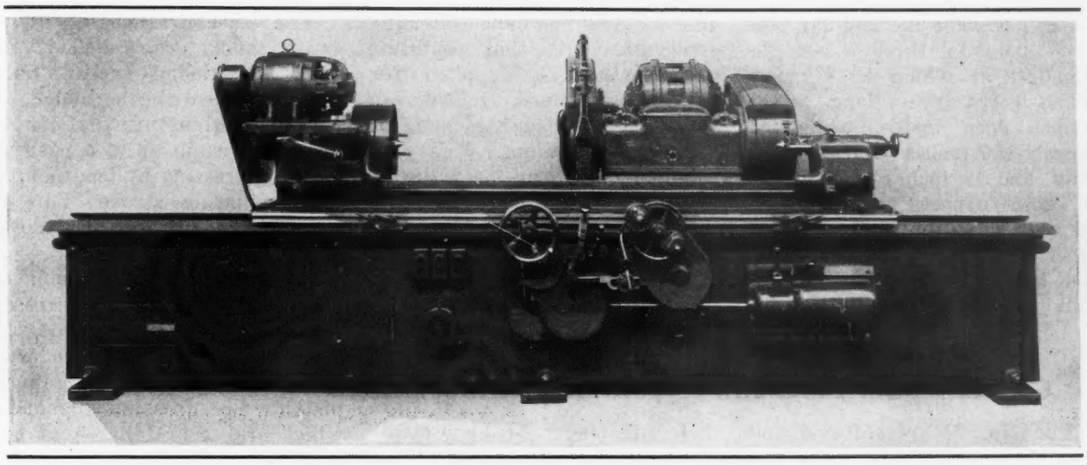
Greenlee Cylinder-Block Drilling and Tapping Machine

The introduction of forced-feed lubrication for the camshaft and crankshaft bearings of automobile engines and the change of the distributor and oil-pump holes from a vertical to an angular position created the need for a machine that would drill, chamfer, ream, and tap all of the angular holes in the cylinder blocks. The four-station machine shown in the accompanying illustration was recently built by Greenlee Bros. & Co., 2135 Twelfth St., Rockford, Ill., for performing these operations on a straight-eight cylinder block.

The cylinder block enters the machine at station No. 1 on the left-hand end with the bottom face down and the distributor side toward the rear. It is transferred manually from one station to the next after each operation, and leaves the machine at the right-hand end. The first three stations are assigned to drilling, counterboring, chamfering and reaming the angular holes. all tapping being performed at the fourth station.



Greenlee Machine for Performing All Drilling, Chamfering, Reaming, and Tapping Operations on the Angular Holes of Eight-cylinder Automobile Engines



Norton Type C Cylindrical Grinding Machine with a Swing of 16 1/2 Inches over the Table

Each station is provided with its own locating and clamping mechanism, as well as an independent feed, so that the stations are actually complete machines in themselves. At each of the three drilling stations, there is a standard cam-feed unit which, through racks and pinions, feeds all drill heads of that station. One of these cam-feed units may be seen at the lower front of station No. 2. Similar units for the first and third stations are at the rear of the machine.

All drill units are independently adjustable for depth of feed, but the total stroke of each rack-feed head is dependent upon that of the cam-feed unit. The feed of the first three stations is electrically controlled by a push-button that operates in conjunction with a solenoid-controlled clutch. All of the tapping heads at the fourth station are independent of each other with regard to stroke, adjustment, and control, each head being provided with a screw feed and being driven by a reversing motor. The motor is equipped with a limit switch and a push-button control.

This machine can be modified with reference to the number of stations and the operations to be performed, to suit various cylinder blocks. It can also be adapted for handling other parts of suitable size and shape.

Norton 16-Inch Type C Cylindrical Grinding Machine

A Type C cylindrical grinding machine has just been brought out by the Norton Co., Worcester, Mass., that is similar in general design to the 10-inch Type C machine described in December, 1933, MACHINERY, except that the swing is rated at 16 inches. The new model is considerably larger and heavier in every detail. The grinding-wheel unit alone weighs nearly 3400 pounds.

This machine is built as motor-driven equipment only. The grinding-wheel spindle is driven by an individual motor mounted directly on the wheel-slide. Likewise, the headstock is driven by an adjustable-speed direct-current motor mounted on that unit, while a third motor drives the pumps and the table traversing mechanisms.

The actual swing over the table is 16 1/2 inches. Either a 30- or a 36-inch diameter grinding wheel can be supplied. The grinding-wheel spindle is over 42 inches long. Both of its bearings are flood-lubricated by oil that passes through a filter just before it enters the bearings. Three sheaves are furnished as standard equipment for the grinding-wheel spindle. Changes from one speed to another are easily effected. Power is transmitted from the motor to the spindle through V-belts without the use of idlers or intermediate shafts.

Either a hydraulic, mechanical, or hand table traverse can be supplied. The table speeds on hydraulically traversed machines range from 6 inches to 22 feet a minute, while on mechanically traversed machines they range from 7 1/2 inches to about 9 1/2 feet a minute.

The headstock of this machine weighs approximately 950 pounds and the footstock weighs over 200 pounds. The machine is built in eight different lengths, ranging from 36 to 192 inches, inclusive. Complete with motors, the 36-inch machine weighs approximately 13 000 pounds, and the 192-inch machine, 26,000 pounds.

Hevi-Duty Round and Rectangular Pot Furnaces

Pot furnaces of round and rectangular construction are being placed on the market by the Hevi Duty Electric Co., Milwaukee, Wis., for heat-treating small parts; melting lead, babbitt, salts, etc.; and for use in experimental work. The round pots are made in two sizes which have an inside diameter of 6 and 8 inches, and a depth of 12 and

14 inches. The rectangular pots are made in three sizes, the smallest of which is 4 inches wide, 6 1/4 inches long, and 8 inches deep inside, while the largest is 7 inches wide, 7 inches long, and 13 inches deep inside.

These furnaces are constructed with an outer shell of heavy steel plate, a top plate of alloy cast iron, and a pot that is available in various metals to suit the work to be done. Readily removable pots that facilitate pouring can be supplied for melting operations. Helical coil-type heating elements made of a nickel-chromium wire are supplied. Uniform heat distribution is obtained by locating the heating elements around the pot. High- and low-temperature slab material is used for insulating purposes.

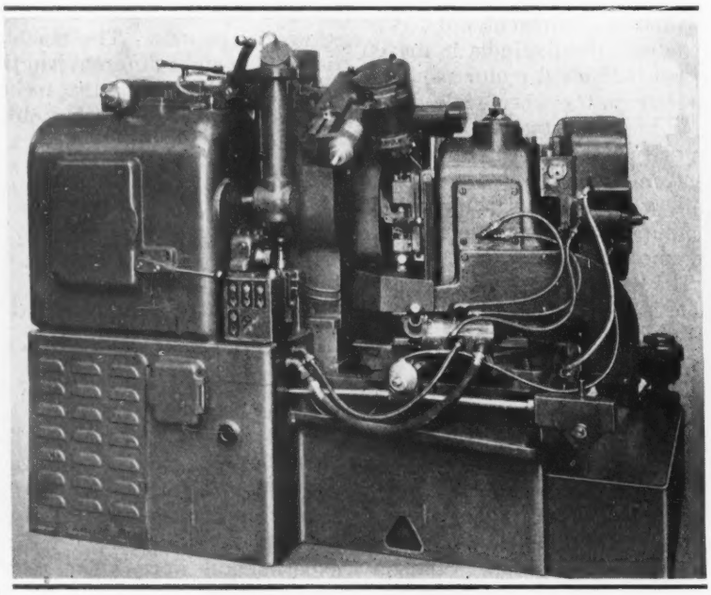
Gleason Spiral Bevel and Hypoid Gear Grinder

The No. 14 spiral bevel and hypoid gear grinder just announced by the Gleason Works, 1000 University Ave., Rochester, N. Y., is a completely new machine which overcomes the difficulties encountered through the deformation that occurs in heat-treating spiral bevel and hypoid gears. This machine permits the teeth of any gear within its capacity to be finish-ground to the closest limits found possible with this operation.

The tooth surfaces are ground with a flaring cup-wheel. It is stated that with this type of wheel spiral bevel and hypoid gears can be ground faster than it is possible to finish cut them.

The gear teeth are ground their full length by an oscillating motion of the wheel. With a wheel of this type, the area of contact is limited; thus stock can be removed rapidly without danger of burning the work. Both sides of the tooth space are ground simultaneously.

In the grinding operation, the wheel is fed into the gear until the full depth position is reached; then the wheel is withdrawn and the gear is indexed. Alternate grinding and indexing proceed until all the teeth have been ground. The machine is then stopped automatically. Separate feed-cams, shifted by a hand-lever from the roughing to the finishing position, are provided for rough and finish grinding.



Front View of Gleason Spiral Bevel and Hypoid Gear Grinder

The wheel-dressing operation is manually controlled. The dressing diamonds are in a fixed position above the normal operating position of the wheel, which is swung up to a positive stop for dressing by lengthening the oscillating stroke. This is accomplished by a single movement of a control lever.

Both sides and the point of the grinding wheel are dressed simultaneously by diamonds, the movements of which are produced hydraulically by a single piston. The dressing diamonds, which are accurately set at the start by vernier and micrometer readings, serve as a gage. The wheel-adjusting unit is hydraulically clamped on all four corners after adjustments have been made to compensate for wheel wear.

The wheel-spindle is mounted on preloaded anti-friction bearings, and is driven from a motor in the base of the machine by a combination V-belt and spiral bevel gear drive. The working mechanism is enclosed.

The chucking and releasing of the work, the moving of the work-head into and out of the operating positions, and the clamping and releasing of the work-head in the operating position are controlled by means of a single manually operated valve. When this valve is moved in one direction, the gear is clamped to the arbor and the work-head advanced into the grinding position, following which the work-head is clamped in position. When the grinding operation is completed, the operator simply moves the same control valve lever in the opposite direction, causing the cycle of operations to be reversed. Manual clamping and unclamping operations are unnecessary. A feature of these automatic functions is that the gear cannot be advanced into the grinding position until it has been properly secured on the arbor.

The machine is stopped automatically after the last tooth space has been ground and a tell-tale light then notifies the operator that the machine is at the proper point in its cycle for

dressing the wheel. Before the gear is clamped in place, it is accurately positioned by a stock-dividing gage to insure an equal removal of stock from each tooth. Conveniently located change-gears permit changing the grinding time per tooth and the number of strokes of the grinding wheel per minute.

Pease Continuous Blueprinting, Washing, and Drying Equipment

Low initial and maintenance costs are advantages claimed for a Model 11 continuous blueprinting, washing, and drying machine that is being introduced to the trade by the C. F. Pease Co., 813-821 N. Franklin St., Chicago, Ill. This equipment is composed of three units—the blueprinting unit, the washing unit, and the potashing and drying unit. The blueprinting unit can be operated independently of the other two units by making a simple clutch adjustment. Also, the blueprinting machine can be obtained separately and the remainder of the equipment added later, if desired.

This blueprinting equipment is made in one standard size handling paper up to 42 inches wide. However, the machine can be built specially for paper up to 54 inches in width. It can be wired for operation on either direct or alternating current of 220 volts. The drive is by a variable-speed 1/4-horsepower motor. A gear shift underneath the feed table provides high and low speeds, as well as a neutral position. Additional printing speed regulation is obtained by a hand-operated dial located on the front of the machine. This dial permits instant change of the printing speed to just the proper rate for any requirement.

Three new type super-actinic high-power enclosed arc lamps provide a range of printing speed from 4 inches to 12 feet a minute. Directly opposite the lamps on the left-hand side of the machine is a fan which provides a constant circulation of air and forces it from the printer, so as to reduce the temperature of the lamp globes and cool the contact glass.

The contact glass is of a new design. It is of larger area than the glass previously used on Pease blueprinting machines of the continuous type. Positive uniform contact is always insured. The glass can be easily adjusted for cleaning by tipping it forward after the lamps have been turned back.

Another important feature of this equipment is a special chemical roll-applicator which was heretofore obtainable only on the higher priced blueprinting machines. This device revolves in the same direction as that in which the paper travels and applies the developing solution uniformly over the entire surface of the prints.

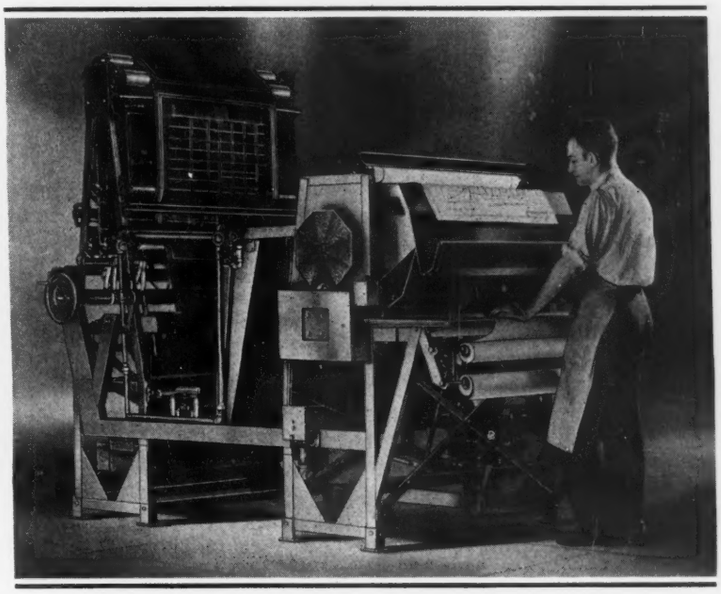
The Model 11 blueprinting equipment is fitted throughout with self-lubricating Oilite bronze bearings which will last indefinitely under normal operating conditions. They possess an oil content averaging 35 per cent by volume, which provides a hydraulic cushion to sustain severe pressure and shock loads.

Shielded-Arc Electrode for General-Purpose Use

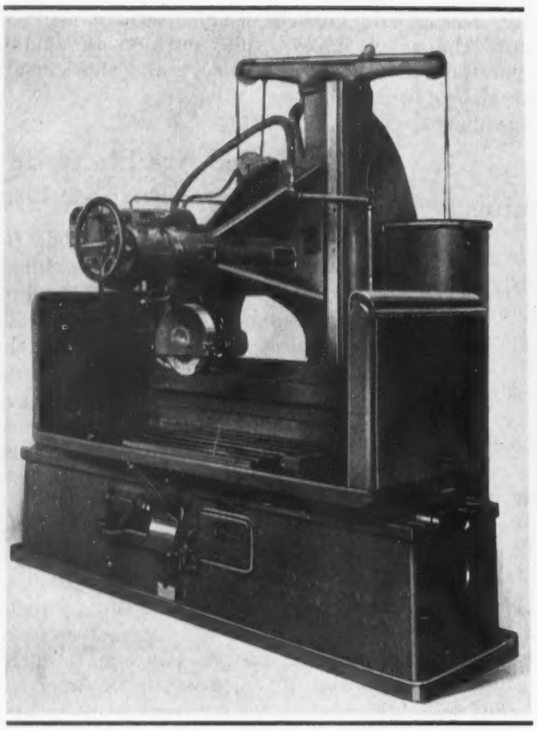
A heavily coated electrode for welding mild steel by the shielded arc method is being placed on the market under the trade name of Fleetweld No. 7 by the Lincoln Electric Co., Cleveland, Ohio. This electrode is designed particularly for general-purpose high-speed and single-pass welding. It has a high burn-off rate and low splatter loss.

Tests made on specimens of all-weld metal have shown a tensile strength of from 70,000 to 80,000 pounds per square inch; a yield point from 55,000 to 60,000 pounds per square inch; and an elongation of approximately 20 per cent in 2 inches.

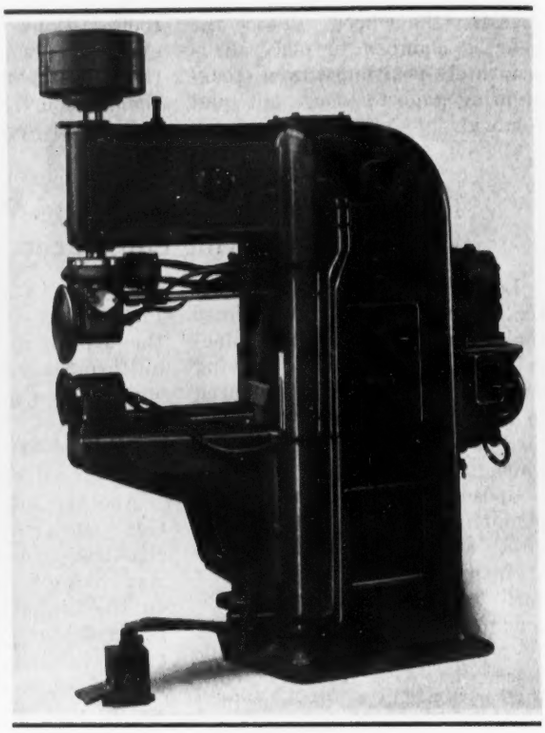
This electrode is made in a variety of diameters, ranging from 1/8 to 3/8 inch, and in 14-inch lengths. The smaller sizes are designed for welding in flat, vertical, and overhead positions, while the larger sizes are intended for use in flat positions only.



Super-actinic Arc Lamps are a Feature of the Pease Continuous Blueprinting Machine



Surface Grinder for Work up to 24 Inches Wide, 24 Inches High, and 36 Inches Long



Taylor-Winfield Seam Welder of Wide Operating Range and Unusual Flexibility

Diamond Grinding Machine of Increased Capacity

A special Type H surface grinding machine that differs from the standard machine in its capacity for wider and higher work has recently been built by the Diamond Machine Co., Providence, R. I. Work up to 36 inches long, 24 inches wide, and 24 inches high can be ground by a 12-inch wheel.

Important changes were necessary in the construction of the rail and head units of the new machine, as will be apparent from the illustration. These units were made considerably heavier to enable work to be finished to a fine degree of accuracy over the entire work area within the capacity of the machine.

Changes were also required in the hydraulic drive to the table to permit parts up to at least 4500 pounds in weight to be handled. Table speeds ranging from 5 to 65 feet a minute are instantly obtainable.

Taylor-Winfield Universal Air-Operated Seam Welders

A wider operating range and greater flexibility than have heretofore been obtainable in conventional seam welding equipment are advantages claimed for the SW-100 Series universal type, air-operated seam welders recently developed by the Taylor-Winfield Corporation, Warren, Ohio. These electric resistance welding machines are so arranged that the rolls can be turned either to the right or the left of the knee in order to perform longitudinal as well as cross welding operations.

The upper roll is driven positively through spiral gears from a gear reduction unit at the rear of the machine, which is connected to the motor by a varispeed drive unit that gives a welding range of from 45 to 130 inches a minute.

The current is carried to the revolving spindles from the spindle bearings by a construction that eliminates freezing and yet provides maximum conductivity and assures smooth running bearings without undue play. Pressure on the upper roll may be supplied by weights that are mounted directly on the head spindle, by an air cylinder that lifts the head, or by a combination of the two. An adjustable stop limits the opening of the upper head, a vertical adjustment of from 1/4 to 2 inches being provided. The lower roll support has a vertical adjustment of 4 inches to compensate for wear on the welding rolls.

A transformer of 100 kilovolt-ampere capacity, of the pancake type with water-cooled secondaries, is mounted inside the fabricated steel frame of these welding machines. Heat regulation is provided through an auto-coil which is also mounted in the welder frame. Leads ex-

tend to a sixteen-step regulator that gives a close adjustment of the welding heats.

The air cylinder which raises and lowers the head is controlled by a four-way foot-operated valve. A pressure switch automatically controls the current in such a manner that it cannot be turned on before pressure is built up on the rolls or cut off before the pressure is released. Current interruption may be provided through a synchronous driven interrupter or a Thyratron control unit.

H-P-M Hydro-Power Plastic Molding Presses

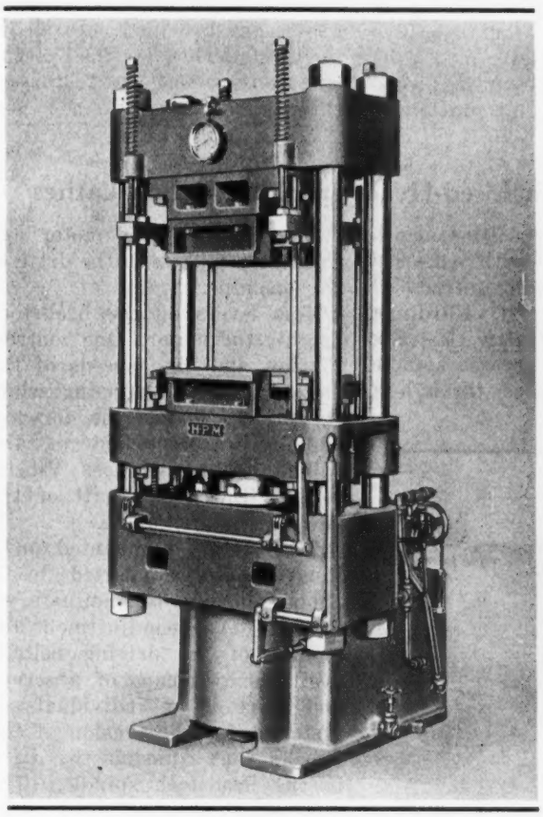
A line of molding presses equipped with individual motor drives and a patented dual-speed Hydro-Power transmission has been developed by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Each of the presses in the line is self-contained, with a hydraulic cylinder and control-valve equipment enclosed within a pedestal that also contains the supply of operating oil.

The most important feature of these presses is the unusually complete control system provided. There is not only an adjustable automatic pressure control, but also a means of regulating the speed of the ram movements and a control that automatically governs the rate of pressure increase according to a predetermined adjustment. The latter control is new in principle and has been developed by the company to supersede the "Stair-Step" method of changing pressures in plastic molding.

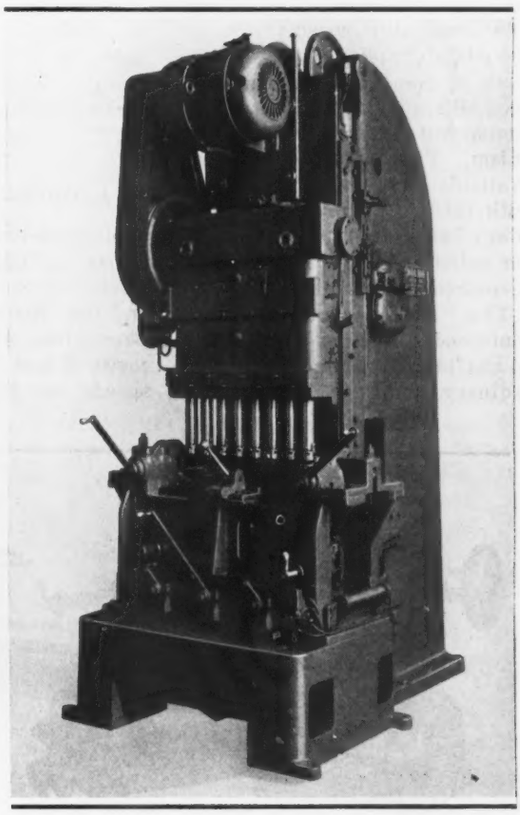
The presses are arranged for rapid closing of the molds as a means of saving time. The speed of both the closing and opening ram movements is controlled independently of the rate of pressure application. The illustration shows one of these presses fitted with bolsters and power ejectors for operating semi-automatic multiple-cavity chambered molds. The presses of this line are available in six standard sizes, with capacities from 50 to 300 tons.

Moline Hydraulically Fed Cylinder Boring Machine

Eight cylinders in automobile engine blocks can be rough-bored, finish-bored, or reamed at one time by the hydraulically fed machine here shown, which was built recently by the Moline Tool Co., Moline, Ill. This machine can be supplied with either adjustable- or fixed-center spindles. The spindles are



Hydro-Power Plastic Molding Press with Control Based on New Principle

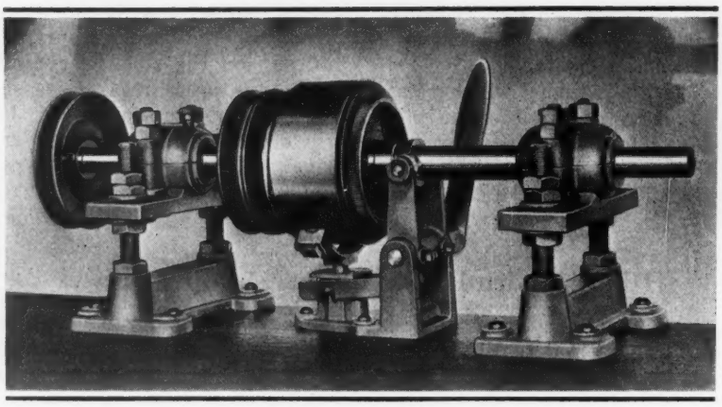


Moline Machine Equipped for Finish-boring Sixty Eight-cylinder Engine Blocks an Hour

mounted in preloaded anti-friction bearings, which makes it unnecessary to use guide bushings either above or below the work. The drive from the motor to the spindles is through V-belts to a main drive worm which, in turn, engages with worm-wheels on the spindles.

The particular machine illustrated is equipped for a finish-boring operation. It is provided with tungsten-carbide tools that run at 250 feet a minute. Approximately 60 cylinder blocks are finished an hour within a tolerance of 0.0005 inch for straightness, roundness, and taper of the bores.

For rough-boring operations, the builder of the machine recommends the practice of machining alternate bores simultaneously in two cylinder blocks, completing the rough-boring of one cylinder block with each cycle of the machine. This practice permits the use of more rugged spindles for rough-boring. Multiple-blade end-cutting tools are generally used. The weight of this machine is approximately 24,000 pounds.



A Drive that Employs a Clutch with a Body Made of Zinc

Walker-Turner Clutch with Combined Brake

A small all-purpose clutch for industrial applications is being made by the Walker-Turner Co., Inc., Plainfield, N. J., with a simple but positive brake mechanism. This clutch is regularly available in two general sizes, with ratings up to 3 1/2 horsepower based on 1800 revolutions per minute. Larger sizes can be furnished to special order.

This "Driver" clutch is a self-contained unit that is installed on shafts in the same manner as ordinary pulleys. The control mechanism can be operated either by a hand-lever or a foot-treadle. The load can be picked up so gradually that practically any speed up to the full motor speed can be obtained.

A large friction area is obtained by using a circular molded-asbestos element of wedge-shaped cross-section. The wedge shape is duplicated in reverse in a ground cast-iron ring. The brake acts directly on the outside surface of the clutch body. The clutch body is a zinc die-casting provided with an inserted steel shell for the braking surface. Low cost is a feature of this construction.

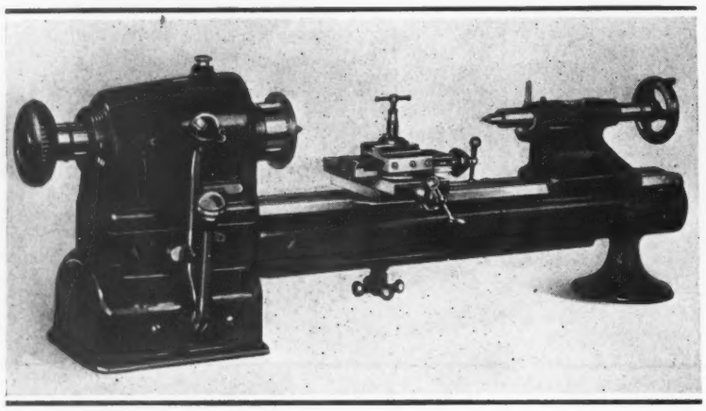
Cataract Enclosed-Head Precision Bench Lathes

Motor-driven precision bench lathes equipped with enclosed headstocks are being introduced on the market by Hardinge Bros., Inc., Elmira, N. Y. Six forward and six reverse spindle speeds are provided through a two-speed reversible motor and three-step pulleys in the drive to the machine.

Two levers on the headstock operate the motor. One controls the low and high speeds of the motor, as well as stopping, while the other controls the forward and reverse rotation of the spindle. Three endless V-belts connect the drive shaft of the lathe with the spindle.

The motor is mounted on a hinged base, supported by a rubber cushion to eliminate vibration. A fine adjustment for tension of the driving belt is available by means of a screw, and there is an individual adjustment for the tension of the V-belts that transmit the drive to the headstock spindle. The drive shaft is supported in self-aligning ball bearings.

These bench lathes are manufactured in five sizes, ranging



Cataract Enclosed-head Bench Lathe with New Speed Control

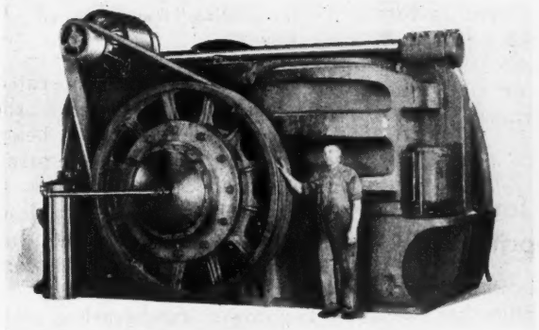
from 1/2 to 1 inch in collet capacity, and from 7 to 9 inches in swing. They are available for bench mounting, as shown, or with a cabinet. The lathes are about 25 per cent heavier than regular cone-driven bench lathes, and it is claimed that heavier cuts can be taken. High spindle speeds can be provided, the maximum speed on the largest and smallest machine, respectively, being 1500 and 2500 revolutions per minute.

Air Clutch Developed for National Forging Machines

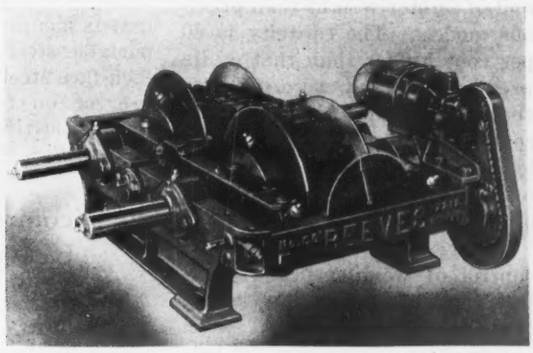
The National Machinery Co., Tiffin, Ohio, announces a new simplified air type clutch as alternate equipment for the quadruple abutment starting and stopping clutch used on the forging machines of this company's manufacture. While the positive type clutch is highly efficient and satisfactory, the pneumatically operated clutch eliminates the noise caused by the pick-up when the clutch block engages the abutment in the gear.

Multiple disks of unusually large area are employed in this design of clutch to lessen the unit pressure and maintain a low temperature, even when the clutch is tripped at frequent intervals. The accompanying illustration shows a 6-inch National forging machine with air-operated clutch. When the air pressure is released, compression springs not only expel the used air, but separate the friction plates to reduce wear and the heating effect. An extremely small amount of air is required and a very low pressure will operate the clutch efficiently.

In conjunction with this air clutch, a "friction-slip relief," of this company's make, can be used as a separate unit to serve as the safety or relief for overloads on the machine. This permits the use of a large-capacity, over-size air clutch which need not serve the double purpose of a driving means and a slip relief, as generally employed. This combination also serves to indicate if the machine is being subjected to overloads. It eliminates uncertainty and makes more practical the employment of an air clutch. The air clutches are built in a full range of sizes by this company, and they can be furnished for other uses when great driving torque and fast operation are required.



National Forging Machine Equipped with New Air Type Clutch



Reeves Variable-speed Transmission with Improved Electrical Control

Reeves Improved Electrical Variable-Speed Controls

Improvements have recently been made by the Reeves Pulley Co., Columbus, Ind., in the design of the electric remote and electric automatic controls that can be supplied for the variable-speed transmissions manufactured by the company. Both controls depend basically on a fractional horsepower reversible motor which drives a speed-shifting screw in either direction as required to vary the effective diameter of a V-belt. This V-belt runs over two sets of adjustable cone-faced disks mounted on parallel shafts. One shaft is operated at a constant speed, and the other, which is connected to the driven machine, at a variable speed.

On the more generally used sizes of the Reeves transmission, the motor that is now provided is of a greatly simplified design and smaller size. It embodies fewer operating parts than before, and hence is quieter in operation and longer lived. It can be mounted in practically any convenient position, and not necessarily on the frame of the transmission. The controls can be installed on units already in service, and on either vertical or horizontal designs.

The motor is rated at 1/16 horsepower. It operates on alternating or direct current. Any ratio up to 1000 to 1 can be obtained by means of a built-in speed reducer. A safety clutch protects the motor in case of overload, this clutch eliminating

the use of the solenoid brake formerly provided. The output shaft of the motor-reducer runs at 150 revolutions per minute and drives the transmission shifting screw through a roller chain.

The electric automatic control makes possible automatic synchronization of any number of machines in tandem or range; the synchronization of separate sections of a single machine; the elimination of waste in materials; and a minimum handling of materials and supervision by operators. The electric remote control makes it possible for the operator to adjust speeds rapidly without leaving his position.

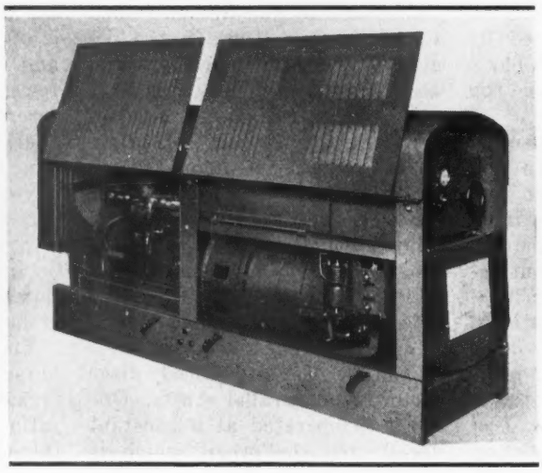
Lincoln Gas-Engine Driven Welder

A close-coupled gas-engine driven "Shield-Arc" welder of 300-ampere, 40-volt capacity is announced by the Lincoln Electric Co., Cleveland, Ohio. This new unit is much more compact and of lighter weight than previous models. The capacity is 60 per cent higher than that of its predecessor, and according to the manufacturer, it has 10 per cent higher efficiency at full loads, and still higher efficiency on overloads, even though it is of much greater capacity.

Other features include dual control of welding heat, sparkless commutation, handy height controls, and arc-welded steel construction. "Lincontrol," a new remote current control device which enables the operator to adjust the current by merely tapping the electrode on the work is supplied as optional equipment. No additional cables or rheostats are carried by the operator. The quick current-adjusting feature is said to eliminate much waste time previously spent in traveling to and from the machine.

The generator is mounted on the engine housing with the drive lined up on hardened-steel driven-on cushioned rubber. This method of coupling takes care of any misalignment and reduces vibration, with the result that the engine operates at high efficiency. A special idling device cuts the engine speed when the arc is broken and thus further assures economical operation of the six-cylinder engine.

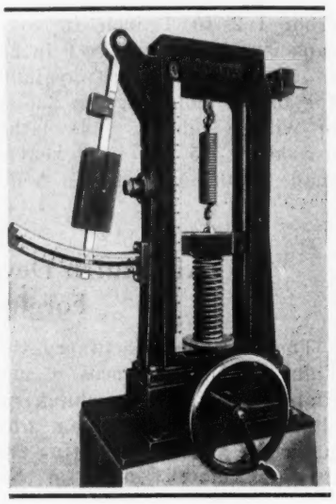
The welder is supplied mounted on a rigid steel base, and is totally enclosed by steel side curtains. When desired, the complete unit is mounted on small factory portable steel wheels or large 6-inch-face steel wheels for outside use, or on two- or four-wheel pneumatic tired trailers.



Lincoln Close-coupled "Shield-Arc" Welder with Gas Engine Drive

Elasticometer for Testing Heavy Springs

A Type DN Elasticometer for testing heavy springs has been added to the line of the Coats Machine Tool Co., Inc., 110 W. 40th St., New York City. This equipment differs from the previous DS type in that the upper compression plate against which the spring under test was pressed has been eliminated. In the new model, a screw-operated cross-head, guided within the frame of the machine, bears down on the compression spring to be tested and compresses it against a lower plate which is suspended from a single-beam weigher scale. This scale is contained in the upper housing.



Elasticometer Designed Primarily for Testing Heavy Springs

The lower compression plate is guided on each side on steel balls that counteract the forces which develop at right angles to the axis of the compression spring that is under load. Such forces would have a tendency to interfere with the free play of the scale beam.

For heavy springs, this method of pulling on the beam is said to be preferable to pushing against an upper compression plate, which, in turn, would push upward on a beam. The same is said to be true of certain slender compression springs intended for carrying lighter loads.

This machine is available in two sizes, having a maximum distance between the compression plates of 31 and 47 inches. The maximum distance between the tension hooks is from 27 to 45 inches.

Portable Brinell Hardness Testing Instrument

The R. Y. Ferner Co., Investment Bldg., Washington, D. C., is placing on the American and Canadian markets a small Brinell hardness testing instrument embodying a number of improvements over the instrument described in February, 1932, MACHINERY, page 472. The new model is supplied with three steel balls, 2.5, 5, and 10 millimeters in diameter, which adapt it for measuring the hardness not only of steel, cast iron, and bronze, but of the softer metals as well, including even lead and copper. Formerly, several instruments had to be supplied to cover the full range of the softer metals.

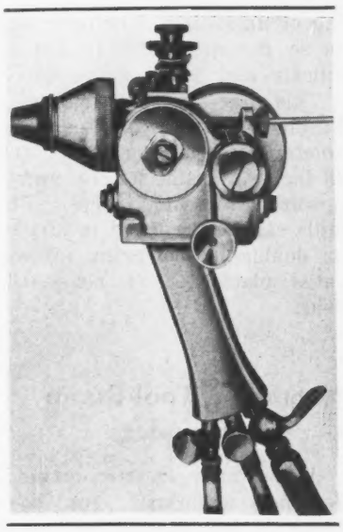
Another important new feature is a dial indicator which gives a reading that is referred to a chart to determine the pressure applied in an inspection. A square-shank holder is provided, so that the instrument can be attached to the toolpost of a lathe for checking a large piece of work while it is in the machine. Holders are also supplied to facilitate the use of the instrument under an arbor press, in a vise, or on a drilling machine.

Loads from 60 to 750 kilograms (132 to 1654 pounds) can be applied with this instrument. A special magnifier is furnished for obtaining accurate readings of the diameter of the impressions made by the steel balls.

Metal Spray Gun

A new type of metal spray gun for use in building up worn or under-size parts, applying corrosion-resistant coatings, and a variety of other purposes for which the spraying of different metals in molten form is employed has been placed on the market by the Metal Spray Co., 113 Llewellyn St., Los Angeles, Calif.

This metal spray gun is made in two sizes, Model 126 and Model 81. Model 126 sprays a very fine, dense deposit particularly suited for building up machine parts. It can deposit six pounds of steel in one hour from wire material 1/8 inch in diameter. The smaller spray gun, Model 81, sprays all metals from wire approximately 0.081 inch in diameter. The larger model weighs 3 3/4 pounds, and the smaller, 3 1/4 pounds.

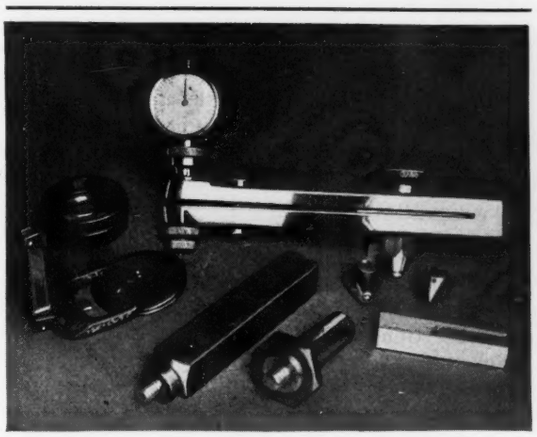


Metal Spray Gun Developed by the Metal Spray Co.

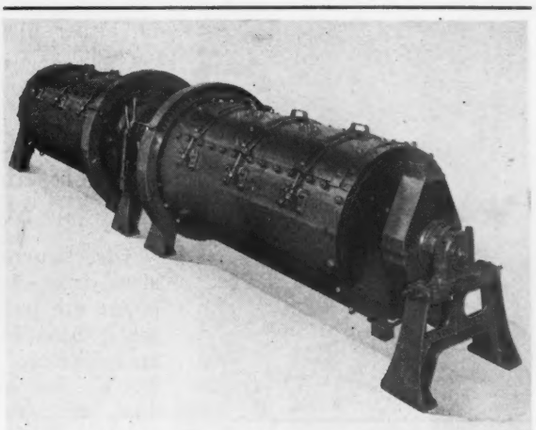
Sly Heavy-Duty Tumbling Mills

Tumbling mills equipped with roller bearings throughout and constructed to prevent warpage under heavy-duty service are being placed on the market by the W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland, Ohio. Tight-pulley, V-belt, and speed-reducer drives can be supplied. Speed reducers of the worm-gear type are used.

Another feature of these tumbling barrels is a combination clutch and brake. The brake is applied by the clutch lever. It provides means for stopping and holding the tumbling barrel in any desired position for load-



Portable Brinell Instrument for Testing Both Hard and Soft Metals



Heavy-duty Tumbling Mill Brought out by the W. W. Sly Mfg. Co.

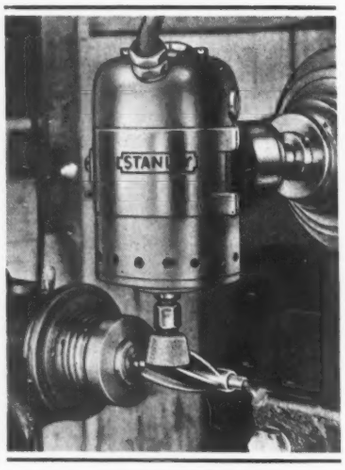
ing or unloading. The door lock is so designed that it can be quickly and easily manipulated.

This line of tumbling mills includes barrels with inside diameters of 24, 30, 36, 42, and 48 inches. Inside lengths range upward from 36 inches. The mills can be arranged in single- or double-file batteries, on elevated platforms, or below the floor.

Stanley Tool-Room Grinder

A portable electric grinder designed primarily for tool-room use has been added to the line of the Stanley Electric Tool Co., New Britain, Conn. This tool is driven at a speed of 18,000 revolutions per minute by a 3/8-horsepower universal motor. It can be mounted in a lathe, milling machine, or shaper, or on a special stand. A variety of abrasive wheels, either straight or mounted, may be employed to grind openings in dies and jigs; to grind keyways and slots; and to perform other internal and external grinding operations.

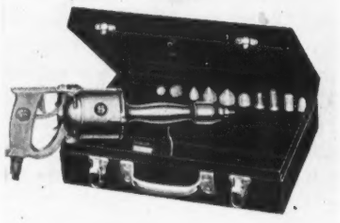
The device may also be used as a hand tool for grinding machine parts and for rough-grinding small castings and forgings. Wheels up to 1 1/2 inches in diameter by 1/2 inch wide can be employed. With a metal-cutting bit, the tool can be used to machine aluminum patterns, brass templets, and other parts made of non-ferrous metals.



Grinding Spiral Cutter on Milling Machine Equipped with Stanley Tool-room Grinder

U. S. Hi-Speed Grinders

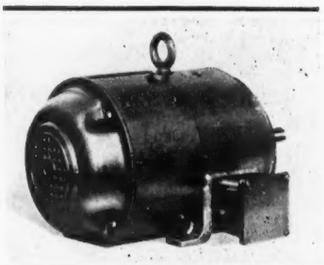
Two small portable electric grinders designed for the removal of excess stock from parts and for finishing operations in automobile-body plants, die and mold shops, pattern shops, foundries, etc., are being placed on the market by the United States Electrical Tool Co., 2490 W. 6th St., Cincinnati, Ohio. Both of these grinders have a speed of 17,000 revolutions per minute. They can be furnished with or without the back handle. The motor is of the universal type, for operation on either direct or alternating current.



Small High-speed Grinder with Carrying Case and Wheels

GE Direct-Current Totally Enclosed Fan-Cooled Motors

Direct-current motors in sizes from 1/2 to 200 horsepower are included in a line recently brought out by the General Electric Co., Schenectady, N. Y., for applications where dust, dirt, moisture, or other foreign matter is present in large quantities. An internal fan draws the warm air from the windings and the core and circulates it around the totally enclosed interior of the motor, so that it gives up its heat to the frame and end shields. An external fan draws cool air in through mesh openings in an outer end shield and directs it over the surface of the magnet frame and inner end shields. Close clearances between the end shields and the bearing housings and grease seals along the shaft prevent foreign particles from entering the motor.



General Electric Direct-current Fan-cooled Motor

These direct-current motors are especially suited for driving such apparatus as machine tools, stokers, conveyors, pumps, and screens. They can be used outdoors in mild climates.

Oster-Williams Pipe-Welding Assembly Bench

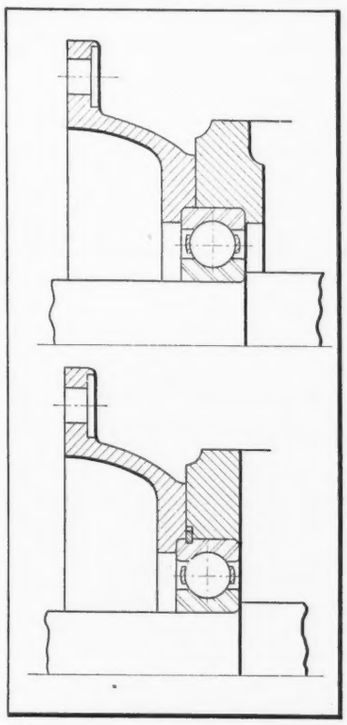
A pipe-welding assembly bench designed to handle all sizes of pipe up to 12 inches in diameter has just been added to the line of pipe-threading equipment made by Oster-Williams, 2057 E. 61st Place, Cleveland, Ohio. This bench is designed to line up accurately and hold in position for tack-welding, fittings, flanges, and branches at any angle. An extension bench can be supplied for handling long lengths. This extension can be set at any angle.

The main bench weighs 700 pounds, and the extension 300 pounds. The bench can be disassembled for portability and reassembled quickly. The I-beam which forms the main bench is 8 feet long by 1 foot wide, and the extension is 6 feet long by 1 foot wide.

Fafnir Groove-Type Ball Bearing

A ball bearing with simplified mounting requirements is being placed on the market by the Fafnir Bearing Co., New Britain, Conn., as the result of three years of development work. This bearing eliminates the need for one of the two shoulders ordinarily required in a housing when it is necessary to provide for taking a certain amount of thrust in both directions.

The new bearing has a groove cut in the outside of the outer race to receive a wire ring which is snapped into place. This wire is located near one face of the bearing, as shown in the bottom diagram of the illustration. It protrudes 1/8 inch or so to furnish a shoulder integral with the bearing itself. The ring abuts against the face of the housing and thus does away with the need for a shoulder on the opposite side of the bearing. This will be apparent from the two diagrams, the upper of which shows an ordinary ball-bearing installation, and the lower a groove-type bearing.



Diagrams Comparing a Groove-type Ball Bearing with the Ordinary Type

Not only does the new bearing enable a simplified housing design to be employed, but assembly is also facilitated and considerable space is saved in the over-all length of the application. The latter feature is particularly advantageous in automobiles and other places where compactness is essential or the weight of the bearing housing is a factor. Housings in which the new bearing is to be used can be bored straight through from one side, thus reducing machining costs.

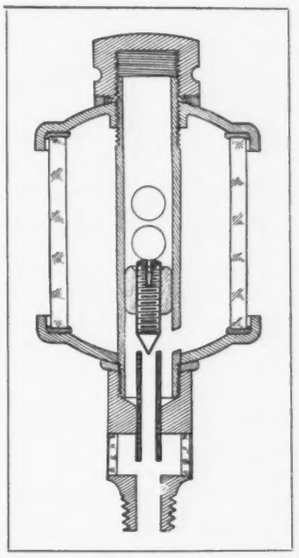
Tests have shown that the snap ring can absorb sufficient thrust for applications where the thrust is incidental only, or where the ring serves the purpose mainly of locating the bearing on the shaft rather than of absorbing purely thrust loads.

The bearing is designated by the letter G appearing after the bearing number. It is available or can be produced in eight sizes of the light 200 series single-row type and seven sizes of the medium 300 series. Grease seals can be furnished, as in the case of the standard single-row bearing, and either the maximum-capacity or non-filling slot type can be supplied.

In the maximum-capacity bearing the wire ring is located on the side opposite the filling slot, and in the case of grease-seal bearings, it is located opposite the seal. In general, the wire is located about 1/8 inch from the face of the bearing in a groove that is approximately 5/64 inch wide by 1/16 inch deep. However, these dimensions vary slightly for different sizes of bearings.

Victor Automatic Lubricator

A number of improvements have been incorporated in the new 1000 series Victor automatic force-feed lubricators recently announced by the Victor Lubricator Co., a subsidiary of the Victor Adding Machine Co., 3903 N. Rockwell St., Chicago, Ill. Among the advantages claimed for these lubricators are increased efficiency through constantly controlled automatic and fool-proof oil supply; oil savings of from 60 to 90 per cent; and no dripping or oil throwing.



Cross-sectional View of Victor Lubricator

Cadmium-plated steel is now used to replace brass in these lubricators, in order to secure greater strength. A new sight feed provides visibility for the reservoir supply, as well as the rate of feed. Easier and faster filling is made possible through the provision of a larger filler tube. A drawn and threaded stamping eliminates the hexagonal nut formerly required. The cap has been redesigned to include a patented washer retainer, which eliminates the cap-retaining wire previously used, and a new valve control inside the filler tube discourages tampering with the adjustment.

These lubricators, like the ones previously made by the company, are of air-tight construction and completely self-contained. They are designed to feed oil under pressure generated within the lubricator—not by gravity—as dictated by the actual needs of the bearing. Oil temperature variation, by causing expansion or contraction

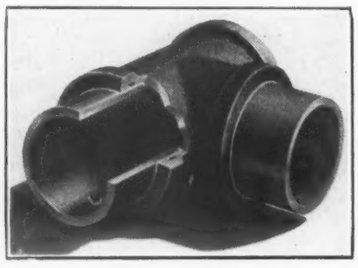
of the small volume of air imprisoned near the base of the filler tube regulates the rate of oil flow.

Bronze Pipe Fittings Without Threads

Threadless bronze fittings made for standard sizes of iron pipe and extra heavy brass and copper pipe have been developed through the collaboration of the Air Reduction Sales Co., the Walworth Co., and Handy & Harman, all of New York City. Instead of threads, the openings of these fittings are provided with a ring of Sil-Fos brazing alloy to facilitate the assembly of pipe. Installation of these fittings consists merely of slipping the pipe into the fitting and then applying an oxy-acetylene flame until a white ring appears between the pipe and the fitting outlet.

The Sil-Fos flows between the fitting and the pipe in both directions from the ring. There can be no clogging of the line due to excessive brazing alloy, and it is impossible to overheat the alloy. Should it be necessary to remove a fitting, it can be used again by merely repeating the operation employed in making the original joint, as there is sufficient brazing alloy in each opening for making two complete joints.

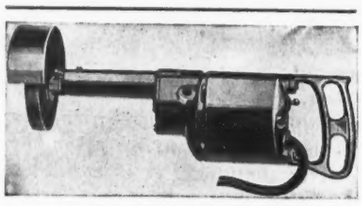
The finished Walseal joint has proved to be stronger than the pipe itself. It is vibration-proof, resists corrosion, will not creep, and cannot be pulled apart under any temperature to which bronze or copper pipe can be safely subjected. These fittings are being manufactured exclusively by the Walworth Co. They can also be used with thin-wall copper tubing having an outside diameter corresponding to standard iron-pipe sizes.



Walworth Threadless Bronze Pipe Fittings

Signal Portable Electric Grinder

A portable light-duty electric grinder that can be taken to the job is announced by the Signal Electric Mfg. Co., Menominee, Mich. The body and handle are of cast aluminum. The over-all length is 14 3/8 inches, the diameter 4 inches, and the weight 9 pounds.

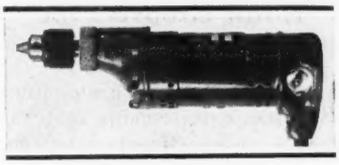


Light-duty Portable Electric Grinder Brought out by the Signal Electric Mfg. Co.

A universal motor for direct or alternating current, 110 volts, 25 to 60 cycles, is used, which has a no-load speed of 3400 revolutions per minute. The bearings are bronze, wool-packed with a thrust ball bearing on the wheel shaft. The equipment consists of an 8-foot heavy-duty rubber-covered cord with rubber plug, and a 4-inch general-purpose grinding wheel.

Hicycle Drill, Screwdriver, and Nut Runner

Holes up to 3/16 inch in diameter can be drilled in automobile bodies, airplanes, metal furniture, etc., by a No. 14 Hicycle portable electric drill now being introduced on the market by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City. This drill is available in three models which have a free speed of 2000, 2400, and 2800 revolutions per minute and a loaded speed of 1840, 2200, and 2575 revolutions per minute.



Bonnet Type Hicycle Electric Drill

The drill is equipped with a quick-acting unit switch which is totally enclosed. The switch can be furnished with either a bonnet or grip handle, both of which are removable. High-speed ball bearings are provided throughout. The weight of the drill is 4 3/4 pounds.

The same concern has also added to the Hicycle line a screwdriver and a nut runner which have been given the designation No. 15N. These tools are similar in design to the drill just described. However, a positive-jaw clutch is built into the nose of the gear-case. The screwdriver can be furnished with rotating and non-rotating types of bits or finders to suit any head or screw within the capacity of the tool. The nut runner is equipped with a spindle to take Walden-Worcester or snap-on sockets direct, this construction providing a tool of short over-all length. The screwdriver weighs 5 1/4 pounds, and the nut runner, 5 pounds.

Spray Gun that Gives a Slow-Speed Spray

A paint spray gun is being placed on the market by the H. D. B. Corporation, 900 N. Spaulding Ave., Chicago, Ill., having a nozzle head that is said to operate on a new principle. This nozzle head produces a highly atomized break-up of the material being sprayed, at a forward speed so reduced that there is a noticeable reduction of the usual spray mist. With this slow-speed spray, paint or liquid that has already been applied to work

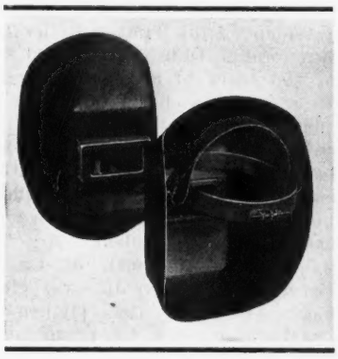
and is still wet does not become rippled as more material is applied. Among the advantages claimed for this spray gun, in addition to a high-grade finish, are high production possibilities and little waste of material.

Welding Helmet for Use in Confined Spaces

A helmet has been developed by the American Optical Co., Southbridge, Mass., for use in welding operations performed in confined spaces, such as tanks, ship hulls, locomotive front ends and fire-boxes. This No. 650 helmet is designed to fit closely to the face and sides of the head without sacrificing ventilation, and thus is cool and comfortable under the most humid conditions.

The Bakelite welding-glass holder is outside of the helmet and is fully dielectric. It insures the wearer of freedom from burns in case accidental contact is made with the electrodes while an operation is in progress. The distance from the face to the glass permits the helmet to be comfortably worn with a respirator and also helps to prevent fogging. Noviweld glass, which is claimed to screen out more than 99 1/2 per cent of all injurious light rays, is standard equipment. A swivel connection provides three positive positions in which the helmet can be set when in use.

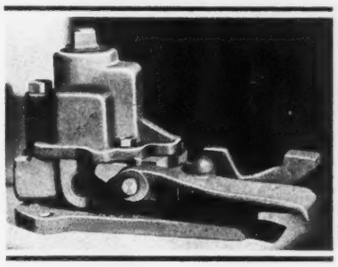
The company has also brought out a new helmet that protects the face from disfigurement and the eyes from injury in work such as the pouring of babbitt or other molten metal which might splash, and in the operation of machine tools where the operator is exposed to large flying particles from brittle metals.



Helmet Designed for Comfort when Welding in Close Places

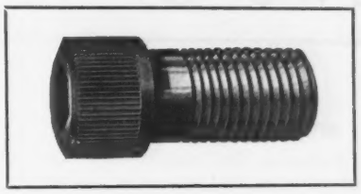
Hanna Spool-Type Foot-Operated Valve

A spool or piston that is fluid-balanced in all directions is the principal moving part of a valve for three-way or four-way distribution brought out by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. The spool moves about 7/16 inch for a full reversal of fluid distribution, and the pedal for foot operation moves through an angle of about 10 degrees. A latch is combined with the pedal to hold it down until unlatched by the foot, whereupon the pedal is raised by a spring to the starting position.



Hanna Foot-operated Valve for Three- or Four-way Distribution of Fluid

By the removal of one pin, the latch may be made inoperative, so that the valve will reverse as soon as the operator's foot leaves the pedal. The large baseplate permits the valve to be operated by the foot without tipping, even though no floor bolts are used in the baseplate holes. Thus, when the valve is connected to the cylinder it controls and to its fluid supply by flexible hose, it can be moved about on the floor until the most desirable position is found.



"Unbrako" Knurled-head Socket Cap-screw

"Unbrako" Knurled-Head Socket Cap-Screw

A socket-head cap-screw with a knurled head has been placed on the market by the Standard Pressed Steel Co., Box 22, Jenkintown, Pa. The new type of screw, for which patents are pending in this country and abroad, is known as the knurled "Unbrako." In driving screws, a mechanic will, whenever possible, screw in the screw partly with his fingers in order to save time. Hence a screw with a knurled head is of great advantage as it makes it possible to obtain a firm grip. This type of screw is particularly useful in the construction of dies and fixtures and is convenient both during the construction and later in the operation of these tools.

Heavy-Duty Industrial Vacuum Cleaner

The Breuer Electric Mfg. Co., 852 Blackhawk St., Chicago, Ill., has developed a Model 112 Tornado industrial vacuum cleaner which is designed for heavy-duty service, although it is light in weight. This equipment is provided with an observation glass which allows the operator to see the dirt being removed from machinery, motors, overhead pipes, walls, etc. A one-horsepower ball-bearing motor drives the vacuum cleaner. The motor unit can be removed for use as a blower.

* * *

The plants that weathered the depression most easily were those having improved equipment.

NEWS OF THE INDUSTRY

Illinois and Indiana

A. B. PETERSON, for many years chief of the division of tool and machine construction for the Hawthorne (Ill.) Works of the Western Electric Co., has been made a director of the Federal Tool Corporation, Chicago, Ill. Mr. Peterson will take charge of the sales engineering for the company, and will direct the sales of dies, precision tools, drop-forge dies, and tools for the metal-working industries.

DELTA-STAR ELECTRIC CO., 2400 Fulton St., Chicago, Ill., announces that the company has been granted a patent license by the General Electric Co. to manufacture oil-blast circuit-breakers.

BANTAM BALL BEARING CO., 3400 W. Sample St., South Bend, Ind., has appointed the G. A. ASHTON CO., of St. Paul, Minn., representative for the Bantam line of automotive replacement bearings in the states of Minnesota, North and South Dakota, Montana, Nebraska, Iowa, and Wisconsin. ROBERT CANNON, of Kansas City, Mo., has been appointed representative in western Missouri and the state of Kansas. F. D. CLARK has been appointed district sales engineer in northwestern Ohio and southeastern Michigan. Mr. Clark is located in Toledo, Ohio, with offices in the Spitzer Bldg. He will handle automotive parts and machinery lines, with special reference to quill bearings.

Michigan and Wisconsin

GIERN & ANHOLTT TOOL CO., INC., 1312 Mt. Elliott Ave., Detroit, Mich., has been incorporated to manufacture special tools and a complete line of tungsten-carbide boring tools. The company will specialize in adjustable cutters, boring-bars, rotating jig and pilot bushings, as well as fixtures for production use in tungsten carbide boring and reaming. The company succeeds the NATIONAL BORING TOOL CO., and has purchased the entire assets and good will of that company. James B. Giern is president, and A. P. Anholtt vice-president and secretary.

H. D. RUNCIMAN has become associated with the Precision Grinding Wheel Co., Inc., Philadelphia, Pa. He will make his headquarters at the company's Detroit office, 2832 E. Grand Blvd., Detroit, Mich.

NORTHEASTERN ENGINEERING CO. announces the removal of its office and shop from 3609 Gratiot Ave., Detroit, Mich., to 3125 E. Larned St., between Elmwood and McDougall.

CHARLES G. CRABB has been appointed sales promotion manager of the Wrought Washer Co., Milwaukee, Wis. Mr. Crabb was formerly executive vice-president of the General Hardware Corporation, and prior to that, was sales promotion manager of the Master Lock Co.

New England

On July 7, ALBERT R. STEDFAST completed fifty years in the machine tool selling business, all of which time he has spent continuously in a business of which he is now the head. On July 7, 1884, he started with Hill, Clarke & Co., Inc., Boston, Mass., as office boy. Later he was employed on sales work in the company's store, and in 1898, he took up the duties of traveling salesman. In 1912 he became secretary and general manager of the company, and in 1927, he formed the partnership of Stedfast & Roulston, which he now heads and which took over the business of the concern that he already had served forty-three years.

Albert R. Stedfast, who has just completed Fifty Years in the Machine Tool Selling Business

PAUL FIELDEN, credit manager of the Norton Co., Worcester, Mass., was elected a director of the National Association of Credit Men at the annual convention in Los Angeles, Calif. Mr. Fielden has been connected with the Norton Co., for about fifteen years.

D. A. NEMSER has been appointed development engineer for the International Nickel Co., Inc., 67 Wall St., New York City. Mr. Nemser will make his headquarters at Hartford, Conn. He was associated for ten years with the metallurgical staff of the Pratt & Whitney Co., Hartford, Conn., during the last five of which he served as chief metallurgist.

RALPH E. FLANDERS, president of the Jones & Lamson Machine Co., Springfield, Vt., well known throughout industry both as an engineer and as an economist, has been nominated for president of the American Society of Mechanical Engineers for the year 1935.

New York

SIVYER STEEL CASTING CO., Milwaukee, Wis., announces the opening of a New York office at 500 Fifth Ave., New York City. This office will specialize in the products of the Oil Refinery Division of the company and in Sivyer stainless steel casting oil refineries. A. N. DIECKS will have charge of the new office.

C. A. MACFIE and C. C. FELTON have been appointed vice-presidents of Revere Copper & Brass, Inc., with offices at the executive headquarters in the New York Central Bldg., 230 Park Ave., New York City. Mr. Felton was formerly sales manager of the Calumet & Hecla Consolidated Copper Co.

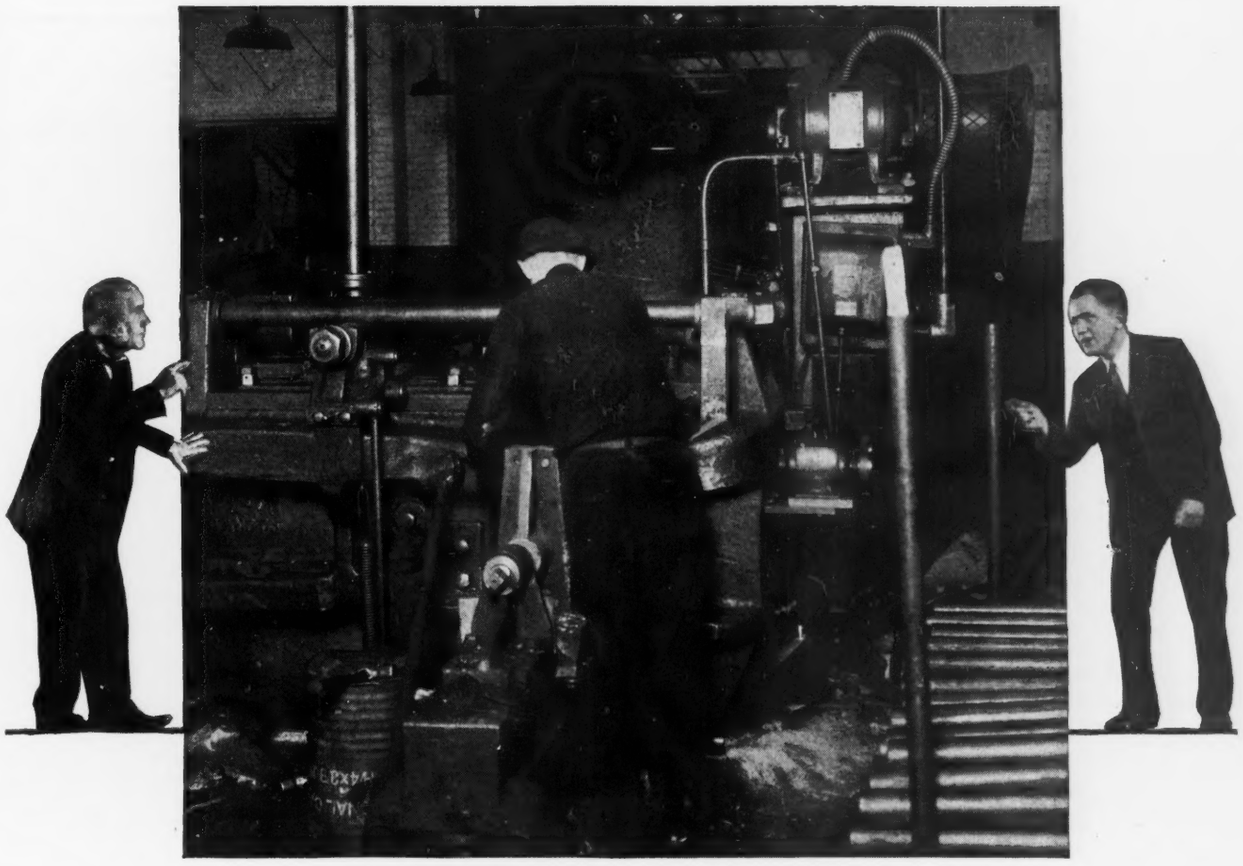
GENERAL AUTOMATIC LOCK NUT CORPORATION has been reorganized, and hereafter the business will be conducted under the name of the AUTOMATIC NUT CO., INC., with offices at the Chrysler Bldg., New York City.

WILLIAM S. GALLAGHER, sales engineer for the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., has opened a new sales office at 1807 Elmwood Ave., Buffalo, N. Y.

Ohio

H. H. TIMKEN recently resigned as president of the Timken Roller Bearing Co., Canton, Ohio, at a special meeting of the board of directors. WILLIAM E. UMSTATTD was elected president in Mr. Timken's place. Mr. Umstattd became connected with the company in 1919, and has successively held the positions of assistant superintendent, assistant factory manager, factory manager, and executive vice-president. Mr. Timken will remain chairman of the board. HENRY H. TIMKEN, JR., was elected a vice-president of the Timken Roller Bearing Co. and a vice-president of the Timken Steel & Tube Co.

NATIONAL MACHINERY CO., Tiffin, Ohio, announces, in connection with its suit against the Ajax Mfg. Co., of Cleveland, for infringement of the National Machinery Co.'s patents Nos. 1,297,101 and



"Motors may all look pretty much alike, Lad — but there's a whale of difference in the way they operate.

"For example, take a look at this Lincoln 'Linc-Weld' driving this bulldozer. The plant super tells me he gets about a pound of torque per ampere of current from this 'Linc-Weld' Type DL. That's more, he says, than he can get from others. Says that's the reason you can go to a smaller size in a 'Linc-Weld' — save money on the initial cost of the motor, and starter as well."

"Are you telling me, Pop? The superiorities of the 'Linc-Weld' half-high torque type DL's are typical of the better operating characteristics of Lincoln's entire line of A.C. motors.

"Their steel construction gives them large air passages . . . cooler operation . . . greater overload capacity.

"These dollar saving advantages in the form of longer motor life, lower maintenance costs and less power consumption are yours when you buy 'Linc-Weld' motors — built by

LINCOLN

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

Manufacturers of "*Linc-Weld*" Motors and "*Shield-Arc*" Welders M-12

Emergency Fleet Welding Committee during the World War and was one of the organizers of the American Welding Society, its vice-president from 1920 to 1922, and the recipient of the Miller Memorial Medal in 1929. In 1928, he was awarded the first prize of $10,000 in the Lincoln Co.'s international competition, sponsored by the American Society of Mechanical Engineers. He is a member of numerous engineering societies and acts on many technical committees.

PITTSBURGH TESTING LABORATORY, Pittsburgh, Pa., announces a new service for manufacturers, fabricators and contractors in the welding field, known as the National Weld Testing Bureau, which is prepared to render several distinct types of services: Reports on welding processes, reports on weld specimens prior to construction, and similar reports made during construction, laboratory tests of weld specimens, inspection of welded products and structures, and investigations of special welding problems. The Bureau will be in a position to assist manufacturers, fabricators, and contractors to comply with such specifications, codes, or rules as may have been adopted.

BRIDGEPORT SAFETY EMERY WHEEL CO., INC., 1283 W. Broad St., Bridgeport, Conn., has appointed THOMAS M. REES, 18 Fancourt St., Pittsburgh, Pa., representative for the company's line of grinding machinery in the Pittsburgh district. Mr. Rees has been engaged in the sale of machine tools for many years, having formerly been with the Motch & Merryweather Machinery Co., and later with the Pittsburgh office of Manning, Maxwell & Moore, Inc., and the Arch Machinery Co.

HOMESTEAD VALVE MFG. CO., INC., Coraopolis, Pa., has appointed REEVES-MCCORMICK, INC., 5317 N. Second St., Philadelphia, Pa., exclusive representative in the Philadelphia district for the sale of the company's "Hypressure Jenny," a vapor spray machine used for automotive, industrial, aeronautical, and building cleaning. F. J. Evans Engineering Co., 1305 Watts Bldg., Birmingham, Ala., has been appointed exclusive representative in the state of Alabama.

SELAS CO., 18th St. and Indiana Ave., Philadelphia, Pa., manufacturer of industrial gas heating equipment, has recently expanded its business to include the design and construction of special automatic machinery for all types of industrial heating processes. P. R. HOOPES, well-known consulting engineer, has been retained as technical consultant on this work.

PENROSE R. HOOPES, consulting mechanical engineer, who for the last twelve years has maintained offices in Hartford, Conn., has transferred his business to Philadelphia, and is now located at 18th St. and Indiana Ave. in that city. Mr. Hoopes specializes in the design of automatic machinery and mechanical products.

L. H. GILMER CO., Tacony, Philadelphia, Pa., held its annual employes' picnic Saturday, August 5, at the Columbus Country Club, Eddington, Pa., when seven hundred people were present as the company's guests. John S. Krauss, president of the Gilmer company, made a brief address of appreciation to the employes.

NEW BOOKS

THE IRREPRESSIBLE CONFLICT—BUSINESS VERSUS FINANCE. By David Cushman Coyle. 45 pages, 5 1/2 by 8 1/2 inches. Published by the author, 101 Park Ave., New York City. Price, single copies, 60 cents; two or more copies, 50 cents each; ten or more copies, 40 cents each.

This is the third edition of a little book that deals with the causes of business depressions and outlines some of the adjustments that may be required to meet the new conditions of industry. It emphasizes the need for economic planning with particular reference to the distribution of income and the allocation of income between equipment and consumption. In his concluding section, entitled "The Dawn of Civilization," Mr. Coyle draws an inspiring picture of the possibilities for a new order in which life will be enriched for mankind as a whole. Every man engaged in business or industry will find the time required to read this little book well spent.

THE OLDER EMPLOYE IN INDUSTRY. 25 pages, 7 3/4 by 10 3/4 inches. Published by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York City.

This booklet presents the findings of a survey covering 5000 manufacturers, which summarizes the plans of 800 of these for dealing with the problem of the older employe.

"TIN-FREE" LEADED BEARING BRONZE. By H. K. Herschman and J. L. Basil. 18 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Research Paper No. 551 of the Bureau of Standards. Price, 5 cents.

A YEARBOOK OF RAILROAD INFORMATION (1933 Edition). 96 pages, 4 by 6 inches. Published by the Committee on Public Relations of the Eastern Railroads, 143 Liberty St., New York City.

OBITUARIES

F. F. WOODS, of 207 Fulton Bldg., Pittsburgh, Pa., factory representative of Roots-Connersville-Wilbraham, Connersville, Ind., died at his home on August 3, after an illness of several weeks duration.

Before becoming associated with the R-C-W organization, Mr. Woods represented the Hayton Pump & Blower Co., Appleton, Wis. When the industrial pump business of this firm was moved to Connersville several years ago, and T. R. Hayton, who had founded the company, located there as engineer of the R-C-W centrifugal pump division, Mr. Woods was appointed district manager of the Pittsburgh area, continuing the sale of Hayton centrifugal pumps along with other R-C-W products.

FRANK W. PEEK, JR., chief engineer of the Pittsfield, Mass., Works of the General Electric Co., Schenectady, N. Y., and one of the company's specialists in high-voltage work, was killed on July 26 when his automobile was struck by a train near Gascones on the Gasp Peninsula of Canada. Mr. Peek was born at Mokelumne Hill, Calif., in 1884. He graduated from Leland-Stanford University in 1905 with the degree of Bachelor of Arts and received the degree of Master of Electrical Engineering at Union College in 1911. He became an employe of the General Electric Co. in 1905, and was a recognized authority on the subject of lightning protection for both buildings and electric systems.

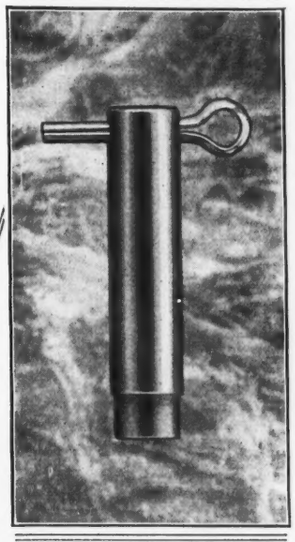
COMING EVENTS

SEPTEMBER 15-16—Annual convention of the NATIONAL ASSOCIATION OF FOREMEN at Akron, Ohio. Secretary, E. H. Tingley, Refiners Bldg., Dayton, Ohio.

OCTOBER 2-6—NATIONAL METAL CONGRESS AND EXPOSITION in Detroit, Mich., under the auspices of the American Society for Steel Treating. Secretary, W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio.

OCTOBER 2-6—Twenty-second annual Safety Congress and Safety Exhibition at the Stevens Hotel, Chicago, Ill. For further information address National Safety Council, Inc., 20 N. Wacker Drive, Chicago, Ill.

Folks—



—this is a pin from one link of a Baldwin-Duckworth Chain. It would require pages to explain the engineering experience which must enter into its design, the expert attention required in the selection, inspection and heat treating of materials used, and the manufacturing precision which is part of its construction.

For example, this pin measuring 5/16 in diameter must have sufficient strength to carry a load of 33 h.p. To accomplish this, every shipment of steel is inspected and tested separately before a single operation is started. Throughout the manufacturing process several other inspecting and testing operations are performed, and individually checked against established standards.

This engineering knowledge and efficiency and this manufacturing accuracy are some examples of the many details responsible for our deserved reputation of producing

Dependable Drives For Every Purpose

BALDWIN-DUCKWORTH CHAIN CORP.

SPRINGFIELD, MASSACHUSETTS

FACTORIES AT SPRINGFIELD AND WORCESTER, MASSACHUSETTS

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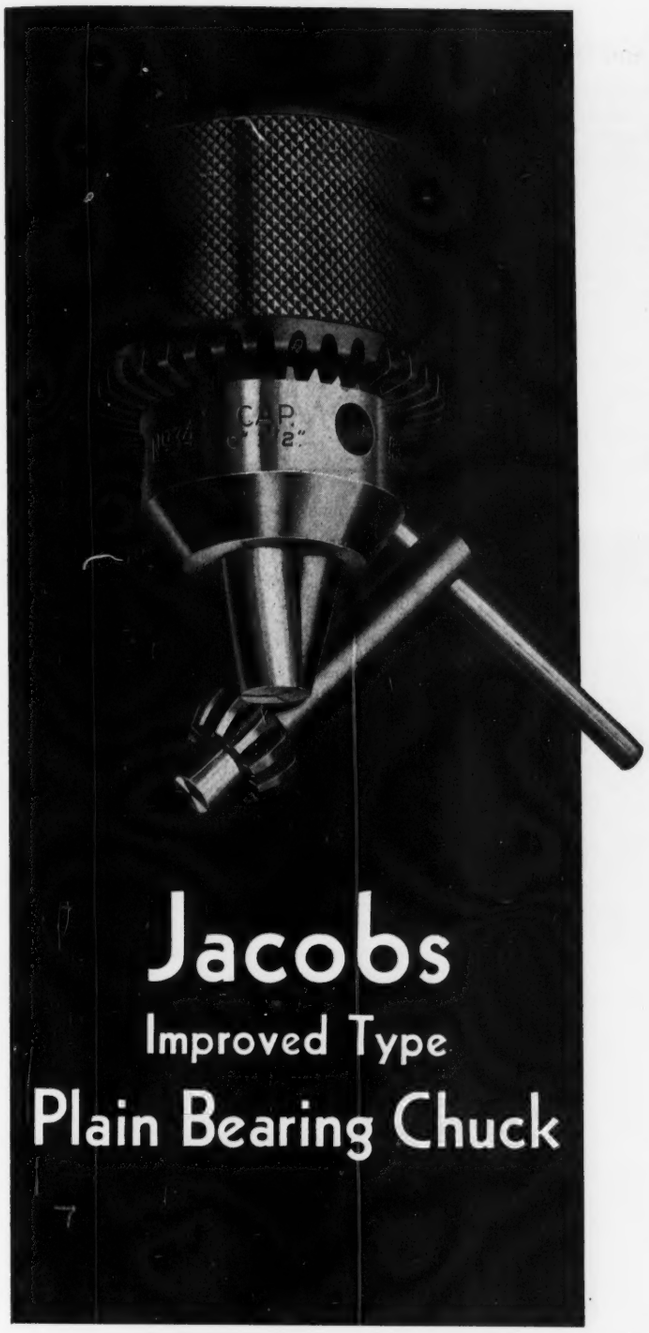
Your Progress Depends Upon Your Knowledge of Your Industry



Bargains Today » Scrap Tomorrow

That's the story of lots of material bought today. Everybody loses in the scramble—the manufacturer who is forced to lower his standards of quality—and the user who is dissatisfied with his "bargains" so dearly bought.

Jacobs Chucks have always maintained the highest standard of quality—in fact year by year they are being improved—a little better steel here—new heat treatment there—resulting in finer accuracy, greater gripping power, higher wearing quality all the time.

Replace those old battered chucks that have lost their grip—are inaccurate or lack balance through constant use and possibly abuse, with new models—they'll inject new life into your drilling machines.

Other JACOBS Products

JACOBS
Ball Bearing
Super Chuck

Combines a high degree of accuracy, gripping power, speed of operation and durability.

JACOBS
Keyless Portomatic
Chuck

For portable tools and machine drilling where the keyless or self-tightening feature is desired.

JACOBS
Positive Drive
Tap Chuck

A New Model for heavy duty, or light sensitive tap holding.

JACOBS
Single Purpose
Chuck

A powerful, accurate small diameter chuck for holding single size tools.

JACOBS
Has Something New in
CHUCKS
Just as Good as Always . . .
Just as Economical . . . .
Just as Practical . . . . .
but
Just One
Step Forward
Jacobs Drilling Chucks

Use the coupon for catalogue matter on all Jacobs Chucks.

COUPON

THE JACOBS MANUFACTURING CO.
Hartford, Connecticut, U. S. A.

Send information on the complete Jacobs Line to:

Name_____

Address_____

City_____ **State**_____

Firm_____

Position_____

GENERAL ELECTRIC Co., Schenectady, N. Y., and four of its associated companies have removed their New York offices to the new General Electric Building, 570 Lexington Ave., at 51st St.

Ohio

WARNER & SWASEY Co., Cleveland, Ohio, has received a contract for the design and construction of the new McDonald Observatory in southwestern Texas, including the second largest telescope in the world. The project will cost approximately $325,000, and, because of the delicate nature of the instruments to be manufactured, will require two and one-half years to complete. The telescope is approximately 26 feet long with a main mirror 80 inches in diameter. It will enable astronomers to photograph stars that are one million times fainter than the faintest star the unaided eye can see.

ALLSTEEL PRESS Co., 12015 S. Peoria St., Chicago, Ill., manufacturer of the Verson Allsteel line of punch presses and sheet-metal working machinery, has appointed E. H. MERRICK, Cook Bldg., Cleveland, Ohio, exclusive representative of the company in the Cleveland district.

J. W. DAVIS, Cleveland manager of the Synthane Mfg. Corporation, Oaks, Pa., manufacturer of Synthane Laminated Bakelite, announces a change in the location of the Cleveland office. The new quarters are at Room 437, Penton Bldg., 1213 W. 3rd St., Cleveland.

FEDERATED SALES SERVICE, 537 Commonwealth Ave., Boston, Mass., announces the appointment of EDWARD T. CLARKE as Ohio representative of the company. Mr. Clarke will make his headquarters at 1236 Standard Bank Bldg., Cleveland.

ALLEN DEVILBISS GUTCHESS, president of the DeVilbiss Co., Toledo, Ohio, manufacturer of spray-finishing equipment, left September 15 for a month's business trip in England and France.

Pacific Coast

HAROLD L. DOOLITTLE, chief designing engineer of the Southern California Edison Co., Los Angeles, Calif., has been elected a vice-president of the American Society of Mechanical Engineers. Mr. Doolittle graduated from Cornell University in 1906. He has been chairman of the Los Angeles Section of the Society, and has been active in the affairs of the Hydraulic Division. At present, he is a manager of the Society and also a member of the American Society of Civil Engineers.

CHICAGO PNEUMATIC TOOL Co., 6 E. 44th St., New York City, announces the opening of a branch office at 1028 Sixth Ave., S., Seattle, Wash., with A. M. ANDRESEN as manager.

Pennsylvania and Delaware

H. E. EWART, formerly assistant chief engineer of the United Engineering & Foundry Co., Pittsburgh, Pa., is now representing the Bantam Ball Bearing Co., South Bend, Ind., in the Pittsburgh district, handling steel mill and industrial bearing applications. Prior to his connection with the United Engineering & Foundry Co., Mr. Ewart had been with the Tennessee Coal, Iron & Railroad Co. for several years.

MAJOR A. E. CARPENTER, vice-president and general manager of E. F. Houghton & Co., Philadelphia, Pa., sailed September 13 to spend several weeks in England inspecting the new plant of E. F. Houghton & Co. of England, Ltd., in Manchester, and conferring with their British representatives Edgar Vaughan & Co. Ltd., in Birmingham.

Major A. E. Carpenter, Vice-president and General Manager, E. F. Houghton & Co.

A. R. SLEATH, 502 Haverford Ave., Narberth, Pa., will represent the EX-CELL-O AIRCRAFT & TOOL CORPORATION of Detroit, Mich., in the Philadelphia territory, handling the company's complete line of products, including those of the Continental Tool Works Division and of the Krueger-Wayne Tool Co. Division. Mr. Sleath has been actively engaged in the machine tool industry for many years.

W. C. HARRIS has been appointed assistant engineer of the transportation department of the General Electric Co. at Erie, Pa. Mr. Harris has been connected with the General Electric Co. since 1911, when he entered the testing department immediately after graduating from the Virginia Polytechnic Institute.

ELY C. HUTCHINSON, president of the Edge Moor Iron Co., Edge Moor, Del., has been elected a vice-president of the American Society of Mechanical Engineers. Mr. Hutchinson has been actively associated with the work of the Society for many years. He is chairman of the Power Test Code Committee for Hydraulic Prime Movers and a member of many other committees. Previous to being elected vice-president, he served as a manager of the Society.

COMING EVENTS

OCTOBER 2-6—NATIONAL METAL CONGRESS AND EXPOSITION in Detroit, Mich., under the auspices of the American Society for Steel Treating. Secretary, W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio.

OCTOBER 2-6—Twenty-second annual Safety Congress and Safety Exhibition at the Stevens Hotel, Chicago, Ill. For further information address National Safety Council, Inc., 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 17-18—Sixteenth semi-annual meeting of the AMERICAN GEAR MANUFACTURERS' ASSOCIATION to be held at Penn-Lincoln Hotel, Wilkinsburg, Pa. J. C. McQuiston, manager-secretary, First National Bank Bldg., Wilkinsburg, Pa.

JANUARY 6-13, 1934—Thirty-fourth annual AUTOMOBILE SHOW at the Grand Central Palace, New York City, under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

JANUARY 27-FEBRUARY 3—AUTOMOBILE SHOW at the Coliseum, Chicago, Ill., under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

OBITUARY

A. S. MAXWELL, sales and advertising manager of J. H. Williams & Co., Buffalo, N. Y., died at his home in Garden City, Long Island, on September 9. Mr. Maxwell had suffered for the last two years from a severe rheumatic condition which fatally affected his heart. He had been connected with the Williams organization for many years, and was widely known throughout the automotive, industrial, plumbing, and pipe fields.

NEWS OF THE INDUSTRY

California

GEORGE H. GATES has been appointed division manager for the state of California by the Federated Sales Service, 537 Commonwealth Ave., Boston, Mass. Mr. Gates will make his headquarters at 880 Twenty-fifth Ave., San Francisco.

Illinois and Michigan

E. AKRIDGE and GEORGE E. POPELAR have recently been appointed sales engineers for the Foote Bros. Gear & Machine Co., 5301 S. Weston Blvd., Chicago, Ill., in the Chicago territory. Mr. Popelar was previously connected with the Hildebrand Engineering Co. and the Industrial Engineering Co.

INLAND STEEL CO., Chicago, Ill., announces that A. M. Castle & Co., Chicago, have been appointed exclusive sales representatives of the company on the Pacific Coast, and will handle the sales of the company's products through their Los Angeles, San Francisco, and Seattle offices.

WILLIAM F. DALZEN is now associated with the National Broach & Machine Co., Detroit, Mich., as vice-president. He was connected with the Michigan Tool Co., Detroit, for many years, and is well known throughout the cutting tool industry.

Missouri

W. K. LEACH, formerly with the General Alloys Co., of Boston, Mass., is now associated with the American Manganese Steel Co., Chicago Heights, Ill., as sales manager of the Alloy Division. Mr. Leach is located at the St. Louis plant of the company, 6600 Ridge Ave., St. Louis, Mo.

FRED E. BYNUM, of Oklahoma City, Okla., has become associated with the Inland Steel Co., Chicago, Ill. He will be affiliated with the St. Louis office, and will sell the company's products in the states of Oklahoma and Arkansas. Mr. Bynum was formerly associated with the Gulf States Steel Co.

New England

ROBERT G. SCOTT has been appointed a vice-president of Revere Copper and Brass, Inc., 230 Park Ave., New York City, in charge of the Taunton-New Bedford Division, with headquarters at Taunton, Mass. Mr. Scott has been associated with this company since its inception in 1929, and was previously connected with the Rome Brass & Copper Co. and the Baltimore Copper Mills, both of which are now part of the Revere organization.

W. E. LOY has been appointed general sales manager of the Union Twist Drill Co., Athol, Mass., with headquarters at Athol. Mr. Loy was president and general sales manager of the Ampco Twist Drill Co., Jackson, Mich., from 1928 to 1933, and is well known in the automobile manufacturing trade and allied industries.

W. E. Loy, General Sales Manager of the Union Twist Drill Co.

J. W. MCIVER, formerly manager of publicity for the Edison Lamp Works and later sales promotion manager for the RCA Radiotron Co., has been appointed sales promotion manager of the Appliance Division, Merchandise Department, of the General Electric Co., Bridgeport, Conn.

New York

H. BOKER & CO., INC., 101 Duane St., New York City, have made arrangements to represent the following companies as distributors: American Rolling Mill Co., manufacturer of stainless steel sheets. Simonds Saw & Steel Co., manufacturer of stainless steel rods, plates, and strip; and chrome and chrome-nickel alloys. Michiana Products Corporation, manufacturer of heat- and corrosion-resisting cast and fabricated alloys; carburizing and annealing lead and cyanide pots; furnace parts; and special alloys.

PACKAGING MACHINERY MANUFACTURERS INSTITUTE, INC., 52 Wall St., New York City, has re-elected the following officers: President, H. H. LEONARD, vice-president and general manager of the Consolidated Packaging Machinery Corporation, Buffalo, N. Y.; vice-presidents, R. L. PUTNAM, president of the Package Machinery Co., Springfield, Mass., and H. KIRKE BECKER, vice-president and general manager of the Peters Machinery Co., Chicago, Ill. W. J. DONALD was re-elected executive vice-president and treasurer.

KELLOGG & TREE is the name of a new company formed to engage in industrial sales promotion work, with offices at 300 Madison Ave., New York City. The firm has been organized by Donald Lewis Kellogg, who for the last eight years has been identified with numerous marketing and distribution problems in sales management work, and Edward Wesley Tree, who has been engaged in management, industrial publishing, advertising, and sales promotion work. Both Mr. Kellogg and Mr. Tree are engineers by profession.

ST. JOHN X-RAY SERVICE, INC., 30-20 Thomson Ave., Long Island City, N. Y., announces that the company will conduct a course on metal radiography at its laboratory beginning February 5. There will be two evening sessions a week for a period of eight weeks. All branches of X-ray and gamma-ray inspection of engineering materials will be covered. For further information address the company.

TOLEDO GENERAL MFG. CO., Toledo, Ohio, manufacturer of the Demco line of standard and automatic sensitive drilling machines, has appointed WILSON & BROWN, INC., machinery dealers, 30 Church St., New York City, exclusive New York representatives.

WAYNE H. PERRY, who is attached to the office of J. W. Lewis, assistant to President Gerard Swope of the General Electric Co., Schenectady, N. Y., has been elected an assistant secretary of the company. He will have offices in the new G. E. building, 570 Lexington Ave., New York City.

Ohio

M. B. BARBE has been made district representative in northern Ohio for the Bantam Ball Bearing Co., South Bend, Ind. Mr. Barbe's headquarters will be at 467 Ohio Ave., N. W., Warren, Ohio. He has been connected for six years with the selling and engineering of anti-friction bearings.

A. V. GROVE has been transferred from the Cleveland office of Steel & Tubes, Inc., to the sales department of the Chicago office. R. E. DOYLE is now sales correspondent in the Cleveland office at 224 E. 131st St. J. F. KEELER is sales engineer at Cleveland.

W. S. GAIN, 416 Lafayette Bldg., Buffalo, N. Y., and E. A. THORNWELL, 217 Whitehall St., Atlanta, Ga., have been appointed district representatives of the magnet department for the Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland.

PERCY W. FENNER, who has represented the Latrobe Electric Steel Co. in the Cleveland district for a number of years and was previously connected with William Jessop & Sons, Ltd., of Sheffield, England, has become a representative of the Firth-Sterling Steel Co. in Cleveland, Ohio.

ROSS MFG. CO., manufacturer of lubricant pumps, announces the removal of its factory and offices to 6402 Cedar Ave., Cleveland, Ohio.

Pennsylvania and Maryland

JOHN E. FIGNER has been appointed representative in the Pittsburgh territory of the Ex-Cell-O, Continental Tool, and Krueger-Wayne Tool Divisions of the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. Mr. Figner's headquarters are at 6388 Penn Ave., Pittsburgh, Pa.

O. B. SCHMELTZ, formerly of the Putnam Machine Works of Manning, Maxwell & Moore, and more recently connected with the Arch Machinery Co., of Pittsburgh, has become associated with Thomas M. Rees, 18 Fancourt St., Pittsburgh, Pa., in representing the Bryant Machinery & Engineering Co. in the Pittsburgh district. The lines handled for Bryant in this district include Dreses radial drills, Boye & Emmes lathes, Ohio horizontal boring, drilling and milling machines, shapers and planers, Cleereman heavy-duty drills, Kling heavy-duty grinders, Imperial arc welders, and Thompson grinders. The Bridgeport Safety Emery Wheel Co. and the Greenfield Tap & Die Corporation are also represented.

WALLACE I. COUSINS has been appointed representative for the Louis Allis Co., Milwaukee, Wis., manufacturer of direct- and alternating-current motors, in the state of Delaware and the District of Columbia, with headquarters at 4402 Kathland Ave., Baltimore, Md.

Texas

INLAND STEEL CO., Chicago, Ill., has opened a sales office at 1511 Kirby Bldg., Dallas, Tex. This office will have charge of sales in the state of Texas (with the exception of the city of El Paso) and the city of Shreveport, La. F. B. McKINNEY will be district sales manager.

Wisconsin and Minnesota

As part of an extensive national sales expansion program, the LOUIS ALLIS CO., of Milwaukee, Wis., announces the appointment of four new members to its sales organization as follows: C. F. CATE, 212 N. 3rd St., Albuquerque, New Mexico, has been appointed representative for the state of New Mexico. ROBERT B. SODERBERG will represent the company in the state of Connecticut, with headquarters at 196 Palm St., Hartford, Conn. N. O. LAWYER has joined the sales organization, working out of the company's New York office located at Room 385, 50 Church St. G. W. CONNER has joined forces with the Cincinnati office, which is located at 1124 Chamber of Commerce Building.

RACINE TOOL & MACHINE CO., Racine, Wis., writes that the company has made a shipment of more than ordinary interest, having recently exported three hydraulic production metal-cutting saws to Vatican City, Italy, the order having been placed by the company's Italian representative, Societa Anonima Emanuele Mascherpa, Milan.

HUGH L. RUSCH has been elected vice-president of the Northern Pump Co., Minneapolis, Minn. Mr. Rusch was formerly supervisor of the Technical Data Section and of the Performance Report Section with the Johns-Manville Corporation, and prior to that was eastern district manager for Arthur C. Nielsen, Inc.

Hugh L. Rusch, Vice-president of the Northern Pump Co. Minneapolis, Minn.

OBITUARIES

HERBERT H. DEWEY, vice-president of the International General Electric Co., Inc., died at his home in Schenectady, N. Y., on October 25, following a short illness.

Mr. Dewey graduated from St. Lawrence University in 1904, and joined the General Electric Co. in 1907 as a student engineer. Two years later he was assigned to the power and transmission section of the power and mining department, and had charge of that section from 1916 to 1921. He was made assistant engineer of the central station department when, in 1921, the power and mining and the lighting departments were consolidated under the name of the central station engineering department. In 1927 and again in 1928 he went to U. S. S. R. for the company, and in December, 1928, was appointed vice-president of the International General Electric Co., with supervision of all interests of the company in connection with U. S. S. R. business.

Long considered a specialist on public utility engineering development, Mr. Dewey was called upon on several occasions to travel extensively in the interests of the company. In 1919, he visited Chile in connection with engineering projects of the Chile Exploration Co. of Antofogasta, and the Braden Copper Co. of Santiago. In 1921 Mr. Dewey spent eight months in Australia, assisting in negotiations for electric equipment for the development and transmission of power from the brown coal fields of Victoria for the supply of Melbourne.

MYRON F. WESTOVER, who retired in 1928 after having been secretary of the General Electric Co. for thirty-four years, died at his home in Schenectady, N. Y., on October 21, at the age of seventy-three years.

Born near Vinton, Ia., in 1860, Mr. Westover was graduated from the law school of the University of Iowa, and in 1882 was admitted to the bar. Four years later he went to Boston, and in 1888 became secretary to Charles A. Coffin, then treasurer and manager of the Thomson-Houston Electric Co., a predecessor of the General Electric Co.

In 1893 Mr. Westover was elected assistant treasurer of the new General Electric Co., and in the following year was elected secretary. He was particularly interested in that part of his work that pertained directly to the employes; he had charge of all insurance matters, was a collaborator in determining the company's pension policies and plans, and was a member of the pension board from its foundation. He was largely responsible for the adoption of the first group life insurance plan for G. E. employes in 1919.

SAMUEL RYNN MORROW, SR., manager of the Birmingham office of the Chain Belt Co., died October 29 from pneumonia, following an operation for appendicitis. Mr. Morrow was a graduate of the Missouri School of Mines, a member of the Birmingham Engineers Club, and a past chairman of the Birmingham section of the American Society of Mechanical Engineers. The management of the Chain Belt Co.'s office in Birmingham will be continued by Mr. Morrow's sons.

JOSEPH W. DAVIS, the Ohio representative of Synthane Corporation, Oaks, Pa., died at his home in Cleveland on October 21.

NEW BOOKS AND PUBLICATIONS

THE BOOK OF STAINLESS STEELS. Edited by Ernest E. Thum. 631 pages, 6 by 9 inches; 200 illustrations. Published by the American Society for Steel Treating. Sold by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, $5 postpaid.

In view of the constantly increasing use and many possible applications of stainless steel, this book—the first one to appear on American practice—will undoubtedly prove of interest to a wide circle of readers. It is unusual in treatment, having been produced through the collaboration of seventy-seven authorities on the making and using of the various kinds of heat- and corrosion-resistant chrome alloys. The material is divided into four parts: The first part, dealing with production and fabrication, covers foundry practice; rolling mill practice; manufacture of seamless tubes; machining; forging; pipe bending; drawing; plate fabrication; forming; cold upsetting and punching; pickling, grinding, and polishing; heat-treatment; welding; and chromium plating. The second section describes the properties of typical alloys and shows the effect of varying compositions, heat-treatments, etc. The third section discusses the applications in a wide variety of industries and describes how the requirements of each industry are met. The fourth section contains a list of trade names grouped according to chemical composition of the different products, as well as a list of manufacturers. This book brings together a fund of definite information which should be of great value to those who use the corrosion-resistant steels. It will undoubtedly suggest profitable applications to manufacturers who have not yet realized the possibilities of these materials in their fields.

UNIFORM COST ACTIVITIES IN TRADE AND INDUSTRY. 46 pages, 8 1/2 by 11 inches. Published by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York City.

As a means of combatting the unsatisfactory conditions that have arisen out of uncontrolled price competition and excessive price cutting, many business men are giving serious consideration to the need for some plan of uniform cost accounting specifically adapted to the problems of their trade and industry. The pamphlet under review has been brought out to meet this need. It recounts the cost experiences of more than seventy-six trade associations and gives, in addition, the ideas of a number of executives in a wide variety of industries. Procedures entailed in administering uniform cost activities and methods of preparing uniform cost accounting manuals are outlined.

REPORT OF THE NATIONAL SCREW THREAD COMMISSION. 171 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Miscellaneous Publication No. 141 of the Bureau of Standards. Price, 15 cents.

COMING EVENTS

DECEMBER 4-7—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in the Engineering Societies Building, New York. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JANUARY 6-13, 1934—Thirty-fourth annual AUTOMOBILE SHOW at the Grand Central Palace, New York City, under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

JANUARY 22-25—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Detroit, Mich. John A. C. Warner, general manager, 29 W. 39th St., New York City.

JANUARY 27-FEBRUARY 3—AUTOMOBILE SHOW at the Coliseum, Chicago, Ill., under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

MARCH 7—Regional meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Washington, D. C. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

JUNE 25-29—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

OCTOBER 22-26, 1934—Annual meeting of the AMERICAN FOUNDRYMEN'S ASSOCIATION and Fifth International Foundry Congress and Exposition in the New Auditorium, Philadelphia, Pa. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

* * *

Metal-Cutting Demonstration at Stevens Institute

As part of the celebration to be held December 7 at Stevens Institute in Hoboken, N. J., in honor of the fiftieth anniversary of the graduation of the late Frederick W. Taylor, a metal-cutting demonstration will be staged. This demonstration has been so planned that it will show the increase in cutting efficiency of steel tools effected by the work of Mr. Taylor.

To insure the best possible cutting conditions, a lathe has been secured with ample power, rigidity, and speed. The tools will be hardened under the best possible conditions and will be uniformly ground on an automatic tool grinder. A graphic cut-meter has been devised, making it possible to read the cutting speed from any part of the auditorium. Tools will be tested to give minimum over-all cost under average conditions, as well as to destruction.

In the tests, five kinds of tools will be used, made, respectively, from plain, high-carbon tool steel; self-hardening tool steel, hardened as recommended by its manufacturer; the same steel hardened as recommended by Taylor; a steel as nearly as possible like that which Taylor considered best in his time; and a modern high-speed steel of the standard 18-4-1 analysis.

* * *

Construction Industry Expands

Contracts for the design and construction of industrial plants obtained by the Austin Co., Cleveland, Ohio, engineers and builders, show a sharp gain over corresponding periods of 1932. For the third quarter of this year, the contracts awarded to the Austin Co., in dollar value, were nearly three times as great as those awarded during the corresponding quarter of 1932. Since January 1, Austin contracts have nearly doubled, as compared with last year.

Bibliography on the Cutting of Metals

In 1930, the American Society of Mechanical Engineers published a "Bibliography on the Cutting of Metals," compiled by Professor O. W. Boston, of the University of Michigan. It included 770 references, with short abstracts, covering the period from 1866 to 1930. Since the publication of this bibliography, Professor Boston has compiled 990 additional references with abstracts, bringing the work up to date. This bibliography will be published if there is a sufficient demand for it. It will sell at a price merely to cover cost (in any event not to exceed $2), depending upon the number of copies ordered. Those interested should write to Prof. Boston, University of Michigan, Ann Arbor, Mich.

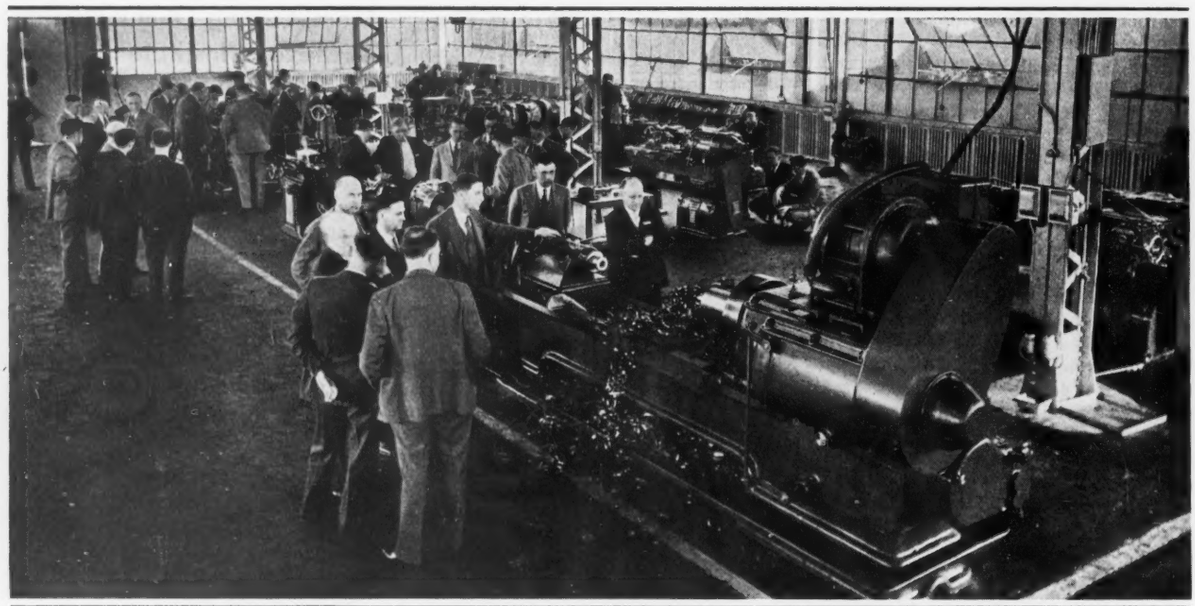
Monarch Demonstration Exhibition

The Monarch Machine Tool Co., Sidney, Ohio, has developed a number of new machines, including a tool-room surface grinder, a Magna-Matic full-automatic lathe, and a cam-milling attachment. In order to bring these developments to the attention of men in the industrial field, a permanent demonstration or exhibit is being staged at the company's plant in Sidney, to which executives and engineers are invited. Several large groups have already visited the exhibition.

A Group of Production Executives Visiting the Monarch Machine Tool Co.'s Permanent Demonstration Exhibition

Machine Tool Orders Show Steady Increase

Machine tool orders have shown a steady increase and are now substantially above the summer level, according to Philip E. Bliss, president of the Warner & Swasey Co., Cleveland, Ohio. "The orders are mostly for replacement of existing equipment," says Mr. Bliss. "The individual orders are small, but the number of them is larger; and they are coming in from a wide variety of industries. Apparently manufacturers in general are beginning to rehabilitate their plants with the expectation of better business through the winter. While the level of the machine tool business is still far below normal, it is better than it has been at any time for two years."



STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF MARCH 3, 1933,

of MACHINERY, published monthly at New York, N. Y., for October 1, 1933.

State of New York } ss.
County of New York }

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None; Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; and Erik Oberg, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press, 140-148 Lafayette St., New York; Estate of Alexander Luchars, 140-148 Lafayette St., New York; Louis Pelletier, 140-148 Lafayette St., New York; Erik Oberg, 140-148 Lafayette St., New York; Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; Laura A. Brownell, 140-148 Lafayette St., New York; Franklin D. Jones, 140-148 Lafayette St., New York; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; and Helen L. Ketchum, Atlantic Ave., Cohasset, Mass.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 22nd day of September, 1933.

CHARLES P. ABEL,
Notary Public, Kings County No. 319
(SEAL) Kings Register No. 5120
New York County No. 207. New York Register No. 5-A-128.
(My commission expires March 30, 1935)

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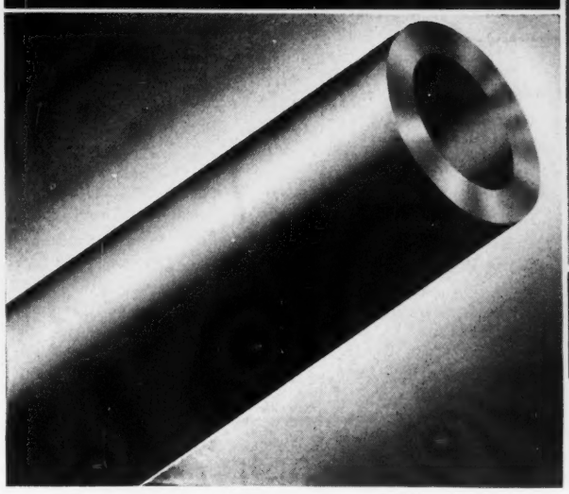

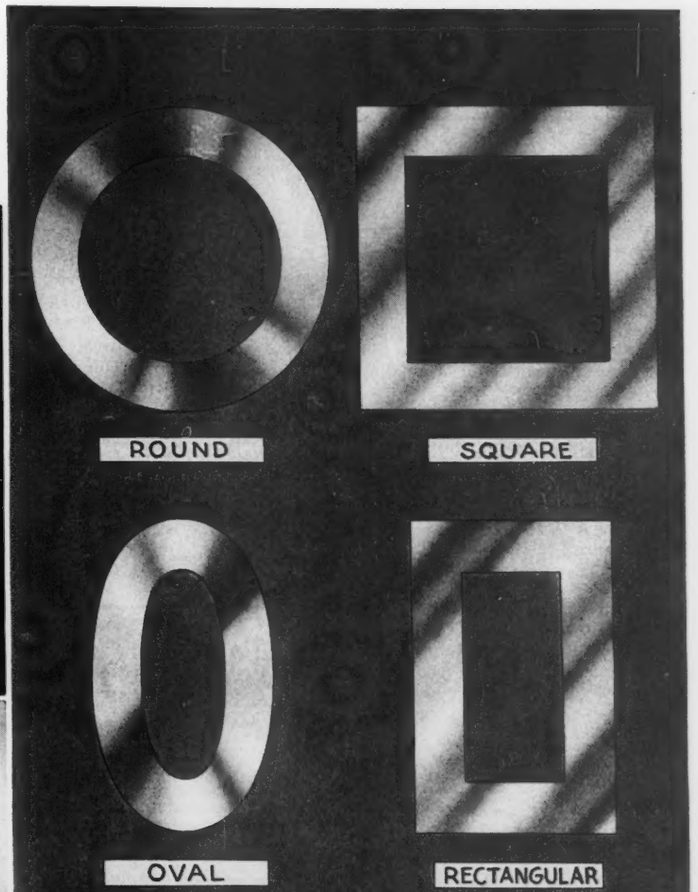

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OBITUARIES

Clifford F. Messinger

CLIFFORD F. MESSINGER, president of the Chain Belt Co., Milwaukee, Wis., died suddenly on the evening of December 12 at his home in Milwaukee. He was in apparently excellent health, had been at the office all day on the day of his death, and was reading at home when he was suddenly seized with a heart attack.

Mr. Messinger was born in New Haven, Conn., in 1889, and graduated from the Sheffield Scientific School of Yale University in 1911, after which he entered the service of the Chain Belt Co. as a student apprentice. In 1913, he became advertising manager, and then, successively, sales manager, general manager, vice-president, and president, to which last office he was elected in 1930.

In addition to being a director in the Chain Belt Co., he was also a director in the Interstate Drop Forge Co., the Sivyer Steel Casting Co., and the Federal Malleable Co., all of Milwaukee. He was also president and one of the directors of the Stearns Conveyor Co. of Cleveland, Ohio, and a trustee of the Northwestern Mutual Life Insurance Co. of Milwaukee, as well as president of the Milwaukee Metal Trades Association. At one time he also held the office of president of the Mixer Manufacturers Bureau and chairman of the Malleable Chain Manufacturers Institute.

In 1917, Mr. Messinger married Gertrude Merker of Milwaukee. He is survived by his wife and four children, and also by a brother, C. Raymond Messinger of Chicago, president of the Oliver Farm Equipment Co.

WHEATON B. KUNHARDT, chairman of the board of directors and former president of the Carpenter Steel Co., Reading, Pa., manufacturer of tool, alloy, and stainless steels, died suddenly, following a heart attack, at his home, 100 Central Park, South, New York City, on November 23 at the age of seventy-four.

Mr. Kunhardt was born at New Brighton, S. I., July 13, 1859. He graduated from the School of Mines, Columbia University, in 1880, with the degree of Mining Engineer. In 1914 he received the degree of Master of Science from Columbia.

From 1880 to 1882 he engaged in graduate study and traveling abroad. From 1883 to 1895 he practiced the profession of mining engineering. In 1895 he became connected with the Carpenter Steel Co., of which he was made treasurer in 1904 and general manager in 1916. In 1920 he became chairman of the board of directors. From 1906 to 1918 he served also as treasurer of the Parish Mfg. Co. at Reading, Pa., maker of automobile frames.

Mr. Kunhardt was a member of the American Institute of Mining and Metallurgical Engineers and the American Iron and Steel Institute.

TILLMAN D. LYNCH, formerly consulting metallurgical engineer with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., died at his home in Edgewood, Pa., after several months' illness, at the age of sixty-six. Mr. Lynch, who recently retired from active duties, was one of the best known metallurgical engineers in the United States, and was a past president of the American Society for Steel Treating. He was born in Harrison County, W. Va., in 1867 and graduated in 1891 from Virginia University with the degree of Civil Engineer. He joined the Westinghouse organization in 1899 and remained with that company until his recent retirement.

COMING EVENTS

JANUARY 6-13—Thirty-fourth annual AUTOMOBILE SHOW at the Grand Central Palace, New York City, under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

JANUARY 22-25—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Detroit, Mich. John A. C. Warner, general manager, 29 W. 39th St., New York City.

JANUARY 27-FEBRUARY 3—AUTOMOBILE SHOW at the Coliseum, Chicago, Ill., under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

JANUARY 31—Joint district meeting of the American Foundrymen's Association, the Cleveland Engineering Society, and the Cleveland Section of the American Society of Mechanical Engineers at the Hotel Statler, Cleveland, Ohio. Subject: "Recent Progress in the Development of Gray Iron, Steel, and Malleable Iron Castings." Frank G. Steinebach, Chairman, Joint Committee, *The Foundry*, Cleveland, Ohio.

MARCH 7—Regional meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Washington, D. C. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia, Pa.

JUNE 25-29—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia, Pa.

NEW PAMPHLETS

SILICOSIS. 32 pages, 5½ by 7½ inches. Published by the Industrial Health Section, Metropolitan Life Insurance Co., New York City. A limited number of copies available free of charge.

In view of the increasing attention given to the effects of silica dust on the health of workers, the Metropolitan Life Insurance Co. has considered it timely to prepare a booklet for the information of plant superintendents and foremen in plants where silica dust is present. In the metal-working industries, the processes particularly referred to are grinding, buffing, burnishing, polishing, and sand-blasting. The book contains a great deal of information showing how to avoid or minimize harmful effects from silica dust.

THE UTILITY OF THE SPARK TEST AS APPLIED TO COMMERCIAL STEELS. By R. W. Buzzard. 14 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Research Paper No. 605 of the Bureau of Standards. Price, 5 cents.

STATISTICS OF MOTOR TRUCK OPERATION IN IOWA. By Robley Winfrey. 72 pages, 6 by 9 inches. Published by the Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa, as Bulletin 114 of the Engineering Experiment Station.

CALENDARS

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DRIVER-HARRIS CO., Harrison, N. J., manufacturer of Nichrome alloys.

* * *

Almost the sole piece of real wisdom that has come to us in the mass of papers and speeches on the Recovery Program is in "A Letter to the President," written by Ralph E. Flanders of the National Machine Tool Builders' Association, chairman of the Code Committee of that organization, which sponsors the letter.—*Commerce and Finance.*

[This letter was published in December MACHINERY, page 225.—EDITOR.]

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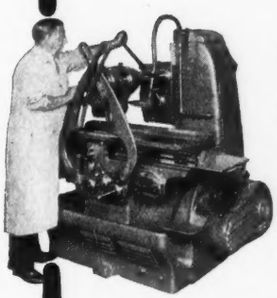

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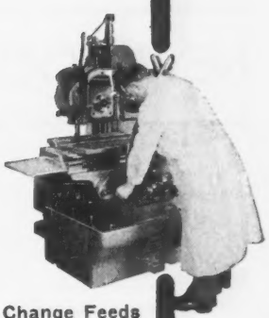

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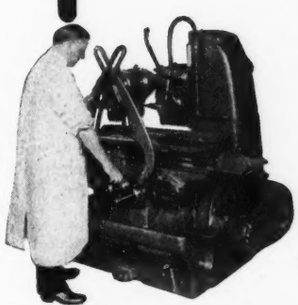

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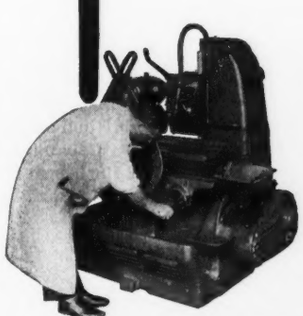

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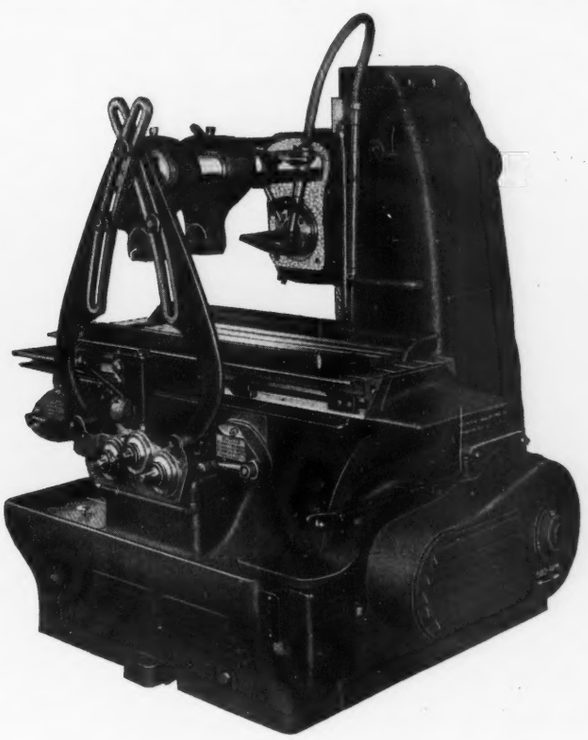

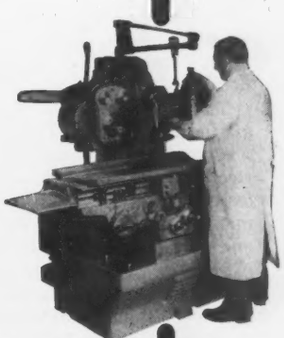

Convenient handling of vertical milling attachment

JOSEPH S. OECHSLE, a consulting engineer with the Worthington Pump & Machinery Corporation, Harrison, N. J., died at the Hahnemann Hospital in Philadelphia on December 24, 1933, at the age of thirty-nine. Mr. Oechsle was one of the founders and subsequently president of Metalweld, Inc., of Philadelphia, manufacturer of portable air compressors, before its consolidation with the Worthington organization in 1931.

WILLIAM BANCROFT POTTER, aged seventy years, long the engineer of the General Electric Co.'s railway department and a veteran of electric traction work in America, died January 15 at his home in Schenectady as the result of a heart attack. Mr. Potter retired September 1, 1930, after forty-three years of service with the General Electric Co. and the Thomson-Houston Electric Co., one of its predecessors.

NEW BOOKS AND PUBLICATIONS

COST AND PRODUCTION HANDBOOK. Edited by A. P. Alford. 1544 pages, 5 by 7 1/2 inches. Published by the Ronald Press Co. Sold by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, $7.50.

It is impossible in a brief space to adequately review so extensive a volume as this, crammed full of information useful to any one responsible for the management of an industrial plant, especially as regards costs and production. This "Cost and Production Handbook" is an entirely new volume, although the foundation for it was laid by the well-known "Management's Handbook," published ten years ago by the same author.

The new handbook, however, differs to a marked degree in concept, topics, and treatment from the earlier volume. The previous book was a pioneer work which sought to organize the information available on the administration and operation of industrial and business companies. The present work presents organized information in the same field from a point of view which is, at once, both narrower and broader—narrower in that it is restricted to manufacturing operations, and broader in that it includes more activities in its field than its predecessor. It further presents the developments and improvements of a decade of intense progress in this field.

The purpose of the book is to cover all the activities of industrial operation. Everything presented is from the practice of representative companies and the experience of successful executives and managers. It is not the work of any one man, but has been created by a board of eighty contributing and consulting managers and engineers, each of whom has special qualifications for the writing or reviewing that he has done.

As mentioned, to give even a conception of the broad and diversified contents is not possible in a brief review. A general idea of the subjects covered may, however, be obtained by listing the twenty-eight sections of the book: Statements and Reports; Production and Expense Budgets; Factory Organization; Measures of Factory Performance; Production Planning and Control; Simplification and Standardization; Purchasing; Raw Materials Estimating; Inventory Control and Storeskeeping; Job and Methods Standardization; Rate Setting; Incentive Plans; Timekeeping and Payroll Procedure; Buildings and Fixed Equipment; Machinery; Small Tools; Handling Materials; Plant and Service Costs; Cost Accounting Methods; Standard Costs; Cost Analysis; Depreciation and Obsolescence; Estimating Product Cost; Development and Research; Principles of Industrial Engineering; Labor; Operating Charts; Symbols and Classifications.

ARC WELDING HANDBOOK. By C. J. Holslag. 274 pages, 5 by 7 1/2 inches. Published by the Electric Arc Cutting & Welding Co., 152 Jelliff Ave., Newark, N. J. Price, $1.50.

This is the seventh edition of a book written by the chief engineer of the Electric Arc Cutting & Welding Co. for the purpose of providing a practical manual of instruction in arc welding. The methods are described in a simple and clear manner, so that the beginner can easily understand both the equipment and the processes. Although the author has kept in mind the needs of the beginner, the work will also prove of value to the engineer, draftsman, and designer, as well as to those who supervise operations of this kind.

The new edition has been brought up to date by supplementary chapters on the shielded arc process; hammer annealing; the normalizing electrode; the flux-coated electrode; and an explanation of fusion welding. It contains twenty-five chapters dealing with the following subjects: Preliminary Instructions and Holding the Arc; Bead Forming; Spreading Welding; Padding Welding; Overhead Welding; Fillet Welding; Lap Welding; Butt Welding; Special Butt Welds and Hole Filling; Irregular Tube Shapes; Tack Welding; Patching Sheets; Tank and Boiler Welding; Welding Heavy Sections; Welding Cast Iron and Malleable Iron; Welding Thin Sections in Cast Iron; Useful Arc Welding Methods and Their Application; Welding of Structural, Sheet-iron, Plate, and Angle Work; Welding of Non-ferrous Metals and Use of Carbon Arc; Electric Arc Cutting; Welding of Alloy Steels; Welding Test Pieces; the Electric Welding Arc and the Eyesight; Use of Gas, Electric, and Thermit Welding, and Electrodes of Various Types; and Rigidity vs. Flexibility in Arc Welding.

THE AMATEUR MACHINIST. By A. Frederick Collins. 300 pages, 5 by 7 1/2 inches. Published by D. Appleton-Century Co., Inc., 35 W. 32nd St., New York City. Price, $2.

This book is intended to be a simple and complete guide for amateurs on the use of machinists' hand and bench tools and lathes, both of the common type and of the screw-cutting type. The first part of the book, dealing with machinists' bench tools, explains what tools are needed; how to measure and gage work; how to hammer, cut and saw metals; how to file, scrape, and polish them; and how to solder, braze, and weld them. In the second part, the author explains how to read working drawings, lay work out, and make fittings. The third section, dealing with power machine tools, takes up the simple lathe and the modern screw-cutting lathe, explains the use of fittings, tools, and attachments, and tells what jobs the lathe can do and how it does them. The final section is devoted to metal-finishing processes.

SYMPOSIUM ON CAST IRON. 164 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., and the American Foundrymen's Association, 222 W. Adams St., Chicago, Ill. Price, $1.

This booklet contains authoritative up-to-date information on the various classes of cast iron, including data on the production and use of this material. The subjects covered include metallurgy of cast iron and alloy cast irons; properties; classification and specifications; heat-treatment; white and chilled irons; welding; and foundry factors of importance in production.

A STUDY OF THE LOCOMOTIVE FRONT END, INCLUDING TESTS OF A FRONT-END MODEL. By Everett G. Young. 182 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 256 of the Engineering Experiment Station. Price, $1.

* * *

The first national standards in the field of electric welding have just been approved by the American Standards Association, 29 W. 39th St., New York City. These standards cover electrical apparatus for arc and resistance welding, and are intended to insure an adequate and properly controlled supply of electric current to meet the exacting requirements of welding service. Generators, transformers, and other equipment are covered by these standards.

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To Production Executives

Sunoco Helps You Secure ..Rated Machine Tool Capacity ..at Minimum Cost

IN your efforts to lower machining costs, don't overlook the real importance of an efficient cutting lubricant. Without it, machine tools will not operate at rated capacity. And it is significant that machine tool manufacturers use and recommend Sunoco Emulsifying Cutting Oil.

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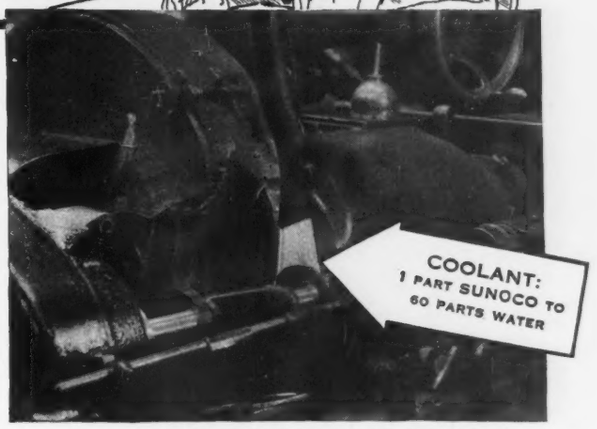
It will pay you to get the facts on Sunoco. Tests in your plant will gladly be made, and our experienced cutting oil engineers are at your service.



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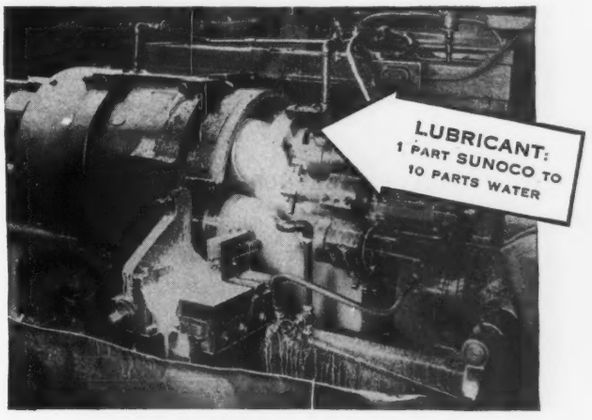
OPERATION: FINISH GRIND, CRANKSHAFT CENTER MAIN BEARING, PLUNGER CUT.
MACHINE: LANDIS GRINDER.
MATERIAL: H. R. TYPE "E. E." STEEL.
SPINDLE SPEED: 750 R.P.M.
WHEEL SIZE: 30 INCH DIAM., 2.188 INCH FACE.
STOCK REMOVAL: .025 INCH.
PRODUCTION: 40 PER HOUR



Courtesy of **NATIONAL ACME** *Co., Cleveland, Ohio*

OPERATION: ROUGH BORE AND ROUGH TURN STEEL FORGING.
MACHINE: GRIDLEY 4-SPINDLE, 4½ INCH CHUCKING MACHINE.
SPINDLE SPEED: 160 R.P.M.
BORE: 129 FEET PER MINUTE.
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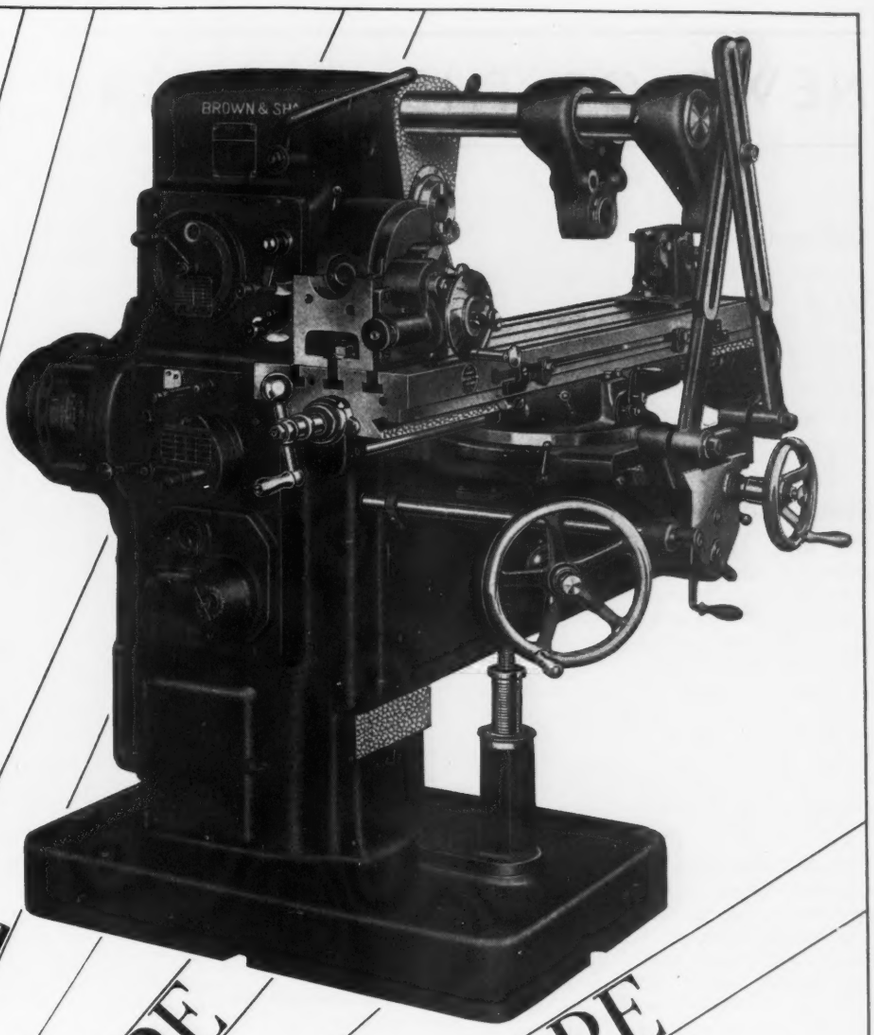

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NEWS OF THE INDUSTRY

California

UNION TWIST DRILL CO., Athol, Mass., has appointed the A. J. GLESENER CO., 975 Bryant St., San Francisco, Calif., representative in San Francisco and northern California for the company's line of milling cutters, gear-cutters, hobs, saws, etc.

Illinois and Wisconsin

W. SCOTT MILNE has been appointed production manager of the Chicago plant of the Ingersoll Steel & Disc Co., a division of the Borg-Warner Corporation. Mr. Milne has had many years experience as a factory executive in the forging and fabricating of steel products. He has been general superintendent of the Fairbanks, Morse & Co.'s plant in Quebec, superintendent of the Massey-Harris Co.'s Toronto plant, and factory manager of the Massey-Harris Co.'s plant at Batavia, N. Y.

HARVEY DIETERICH, manager of the structural department of Joseph T. Ryerson & Son, Inc., Chicago, Ill., has been made assistant vice-president in charge of the operations of the structural and special order departments. Mr. Dieterich has been connected with the company for thirty years. AINSLIE Y. SAWYER has been appointed assistant general manager of sales. He has been with the organization for twenty-five years. Mr. Sawyer will specialize in the field promotion of Ryerson products.

Harvey Dieterich, Assistant Vice-president of Joseph T. Ryerson & Son

Ainslie Y. Sawyer, Assistant General Manager of Sales of the Ryerson Organization

PROFESSOR MELVIN L. ENGER, a member of the University of Illinois faculty since 1907 and head of the department of theoretical and applied mechanics since 1926, has been made dean of the College of Engineering and director of the Engineering Experiment Station.

GEUDER, PAESCHKE & FREY CO., W. St. Paul Ave. and N. 15th St., Milwaukee, Wis., has appointed the following representatives for the stamped and pressed metal division of the company: ARNOLD L. NACKE, 50 Church St., New York City, for the metropolitan district; G. DOUGLAS MORSE, 542 High St., West Medford, Mass., for the New England district; and GUSTAV A. REINHARD, 1935 Euclid Ave., Cleveland, Ohio, for the Cleveland district.

H. F. Kluender, Vice-president of the Detroit Alloy Steel Co.

Michigan

HERMAN F. KLUENDER has been elected vice-president of the Detroit Alloy Steel Co., Detroit, Mich. EDWARD A. KRELLER, works manager of the Detroit Gray Iron Foundry Co. and the Detroit Alloy Steel Co., has been elected to the board of directors of the Detroit Alloy Steel Co.

E. A. Kreller, Member of the Board, Detroit Alloy Steel Co.

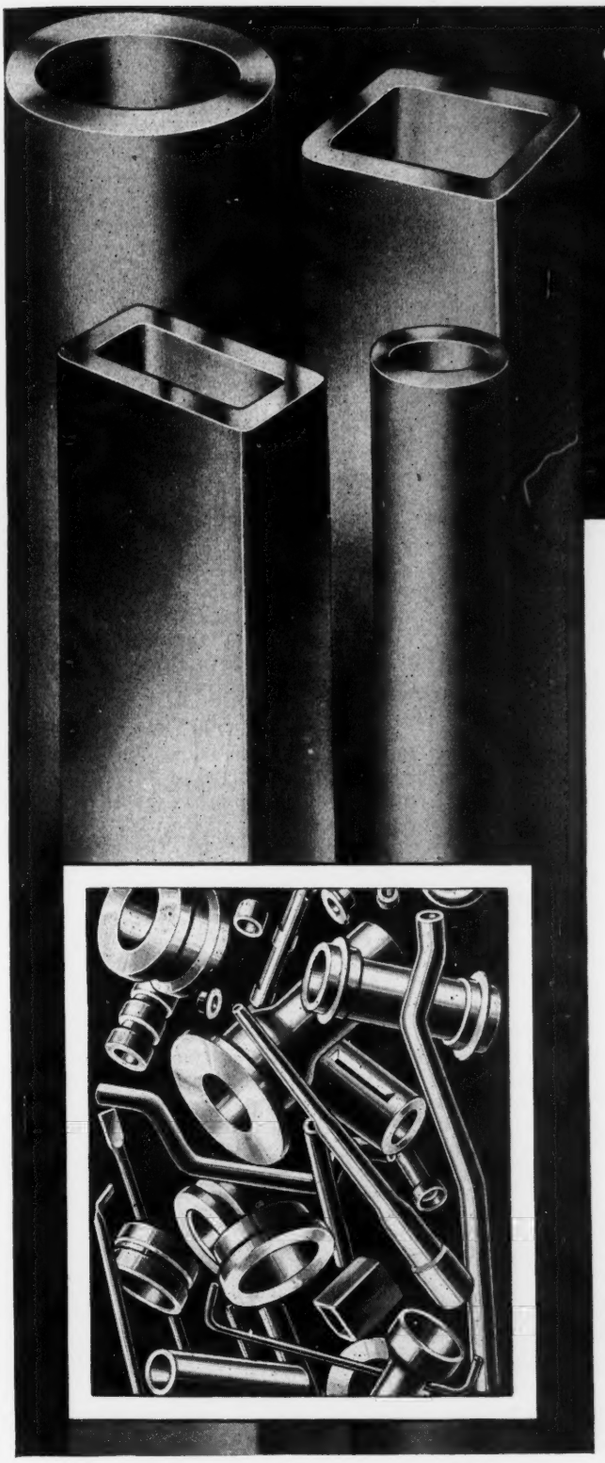
SWEDISH GAGE CO. OF AMERICA, 7310 Woodward Ave., Detroit, Mich., has taken over for the United States and Canada the entire output of the R & M Mfg. Co., Detroit, manufacturer of standard plug and ring gages and special gages.

W. H. WASCHER, who has been with the Chevrolet Motor Co. for the last twenty years, has joined the sales force of the Welker Machinery Co., Inc., 411 New Center Bldg., Detroit, Mich.

VINCENT P. RUMELY has returned to the Hudson Motor Car Co., Detroit, Mich., as division superintendent in charge of trimming, car assembling, and domestic and export shipping.

New England

ANDREW B. HOLMSTROM has been appointed works manager of the Norton Grinding Wheel Co., Ltd., at Welwyn Garden City, Hertsfordshire, England. Mr. Holmstrom will succeed FRANK M. RYAN, who has been appointed assistant to Herbert A. Stanton, now European manager of the Norton Co., Worcester,



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Mass. Mr. Holmstrom has been associated with the Norton Co. more than fifteen years. He was at one time assistant plants engineer; served as a department head; went to England as resident engineer to supervise the construction of the English plant; and recently has been technical secretary to George N. Jeppson, vice-president and treasurer.

STAR TOOL & MFG. CO., INC., has moved from 172 Wade St., Bridgeport, Conn., to 170 Cherry St., Bridgeport.

New York

ST. JOHN X-RAY SERVICE, INC., 30-20 Thomson Ave., Long Island City, N. Y., is planning to arrange for another training course in metal radiography at the company's laboratory. The course will be given for out-of-town people on four successive days. It is intended to hold the course during the week beginning July 2, which is the week following the meeting of the American Society for Testing Materials in Atlantic City. Further information can be obtained from the company.

R. H. BINNS, JR., and S. H. WILSON have been appointed assistant general sales managers of Revere Copper & Brass Inc., with headquarters in the general sales department, New York Central Bldg., 230 Park Ave., New York City. Mr. Binns was previously manager of the Pacific Coast sales district, with office in San Francisco. Mr. Wilson comes to New York from the Michigan division of the company, with which he has been connected for the last twelve years.

BATT L. SPAIN, who has been manager of turbo-blower sales at the West Lynn Works of the General Electric Co. for the last twenty-four years, is now manager of the turbo-blower department of the Ingersoll-Rand Co. Mr. Spain will be located at the general offices of the company, 11 Broadway, New York City. The transfer of Mr. Spain is due to the acquisition of the General Electric turbo-blower business by the Ingersoll-Rand Co.

WILLIAM F. SAILER, formerly with Alco Products, Inc., and the Griscom-Russell Co., of New York, has recently become connected with Steel & Tubes, Inc., Cleveland, Ohio. Mr. Sailer will be located at the Brooklyn office and will concentrate his efforts on the oil-refinery and marine fields.

F. B. COYLE, metallurgist of the research department of the International Nickel Co., Inc., New York, spoke on the subject "American Progress in the Use of Alloys in Cast Iron" at the meeting of the Connecticut Foundrymen's Association at Meriden, Conn., April 20.

CITY MACHINE & TOOL WORKS, Dayton, Ohio, announce the appointment of Don F. Johnson & Co., Inc., 156 Main St., Buffalo, N. Y., as representatives for the Cimatool-Paulins standard drill jigs and locks in the Buffalo district.

PROVIDENCE ENGINEERING WORKS, INC., Providence, R. I., have appointed R. LEWIS GIEBEL, 236 W. 55th St., New York City, exclusive representative in the New York territory for the company's line of sensitive ball-bearing drill presses.

Pennsylvania and New Jersey

DAVID ADAMS has been appointed Pittsburgh sales manager of the Falk Corporation, Milwaukee, Wis., succeeding W. O. BEYER, who recently resigned to become a member of the Pittsburgh Civil Service Commission. Mr. Adams has been with the Falk Corporation for the last four years in the sales department at Milwaukee, and previously was with the National Malleable & Steel Castings Co., Sharon, Pa., and the W. A. Riddell Co., Bucyrus, Ohio, in charge of foundry and sales. His office will be in the Grant Building, Pittsburgh.

L. H. GILMER CO., Tacony, Philadelphia, Pa., manufacturer of belting, announces that a decision in the company's favor has been rendered by the District Court of the Southern District of Ohio in the suit for patent infringement brought against the L. H. Gilmer Co. by the Dayton Rubber Mfg. Co. The Court held, according to the announcement, that the Gilmer belt is not an infringement of the patent owned by the Dayton Rubber Mfg. Co.

DONALD R. DOHNER, formerly director of art in the engineering department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and ALEXANDER J. KOSTELLOW, professor of industrial design at the Carnegie Institute of Technology, have established offices at 99 Vandergrift Bldg., Pittsburgh, where they will carry on an industrial design and research service.

HOMESTEAD VALVE MFG. CO., Coraopolis, Pa., has appointed the BECKWITH MACHINERY CO., Pittsburgh, Pa., distributor for the Hypressure Jenny in sixteen counties of the tri-state area around Pittsburgh.

SERVICE MACHINE CO., 750-760 Broadway, Elizabeth, N. J., has appointed the PRODUCTION MACHINERY SALES CO., INC., Detroit, Mich., sales representative for the line of presses, dies, tools, and special machinery made by the concern. L. HERES DEWYK & SON, Derby, Conn., have been appointed sales representatives in the New England states. THOMAS F. DONNELLY, Westfield, N. J., has been added to the local sales force of the company.

Ohio

ROBERT E. W. HARRISON, Cincinnati, Ohio, has been made chief of the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, succeeding W. H. RASTALL, who has headed the Industrial Machinery Division for many years. Mr. Rastall has accepted an executive position with the Capital Goods Section, Division of Research and Planning of the National Recovery Administration. Mr. Harrison was mechanical engineer with the Cincinnati Milling Machine Co. and chief engineer of the Cincinnati Grinders, Inc., from 1926 to 1932.

GEORGE A. DECKER, works engineer for the Warner & Swasey Co., Cleveland, Ohio, celebrated the fifty-second anniversary of his association with the company on March 23. Mr. Decker started as an apprentice two years after the organization of the company in 1880. Since then he has acted as foreman, assistant superintendent, superintendent, and works engineer. When Mr. Decker first went to work for the Warner & Swasey Co., the late Worcester R. Warner acted as shop foreman and Ambrose Swasey was in charge of the drafting-room. There were less than thirty people on the payroll at that time.

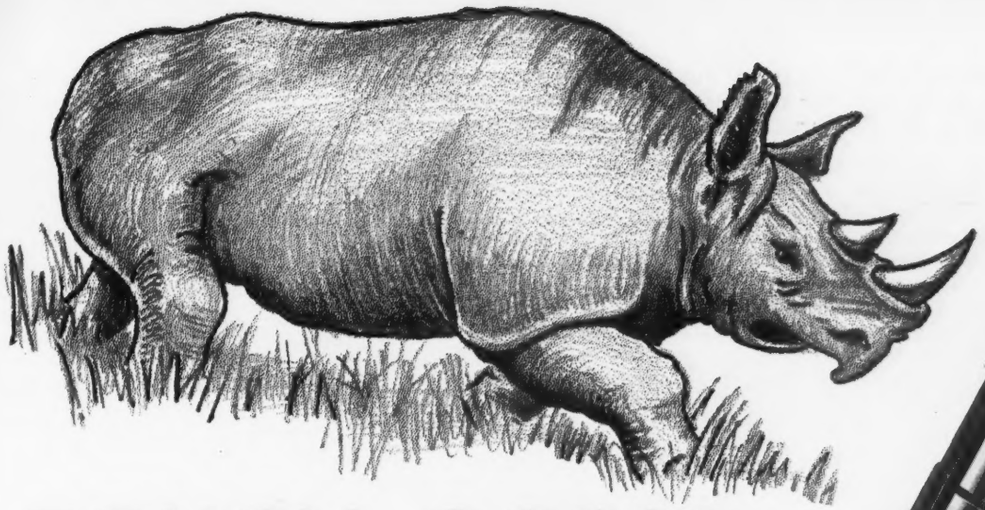
H. O. SWOBODA, INC., 4301 Main St., Pittsburgh, Pa., announce the appointment of MAXFIELD PEASE, 4614 Prospect Ave., Cleveland, Ohio, as exclusive sales representative for the entire northern Ohio territory covering the company's lines of Falcon continuous electric heat-treating furnaces, Falcon bare electric immersion heaters, and other Falcon industrial heating equipment for special applications. Mr. Pease succeeds the late E H. Merrick.

SHEFFIELD MACHINE & TOOL CO., Dayton, Ohio, precision gage manufacturer, has appointed J. A. Bouslough, 606 North Ave., Wilkinsburg, Pa., sales representative for the Pittsburgh district. Don F. Johnson & Co., Inc., 156 Main St., Buffalo, N. Y., have been appointed sales representatives of the company for the Buffalo district.

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, has appointed the BARDE STEEL CO. and the DORAN CO., both of Seattle, Wash., and the EARLE M. JORGENSEN CO., of Los Angeles, Cal., distributors of Enduro stainless steel. The company also announces the appointment of the GATE CITY IRON WORKS, Omaha, Neb., as distributor of Toncan copper-molybdenum iron and Enduro steel.

A. P. FINLEY has been made division manager of the Federated Sales Service, 537 Commonwealth Ave., Boston, Mass., for the state of Ohio, with headquarters at 1924 W. 58th St., Cleveland. Mr. Finley was previously connected for several years with the Henry L. Doherty Co. in the Cleveland territory.

FRANK F. SEAMAN, general manager of the Hoist & Crane Division, Robbins & Myers Sales, Inc., Springfield, Ohio, was elected chairman of the Electric



TOUGH GOING
Can't Stop It—

Speed — power — irresistible driving force — the Carbo-Lathe equipped with modern cutting tools is breaking through to production records on a wide range of single and multiple tool work.

In one instance, Morse Twist Drill & Machine Co. reduced their costs 52% by installing the Carbo-Lathe and improved finish besides. The job was turning carbon steel tips 12″ long, 5/8″ diameter, held to .001 inch.

Another case—manufacturer of world's fastest selling automobile uses a battery of 29 Carbo-Lathes for turning transmission parts. One operation requires holding bronze ring on expansion arbor. Piece is turned, faced, chamfered and grooved simultaneously with 5 tungsten carbide tools. Production 120 pieces in 50 minutes. Pieces shown at right are typical examples of work turned on the Carbo-Lathe.

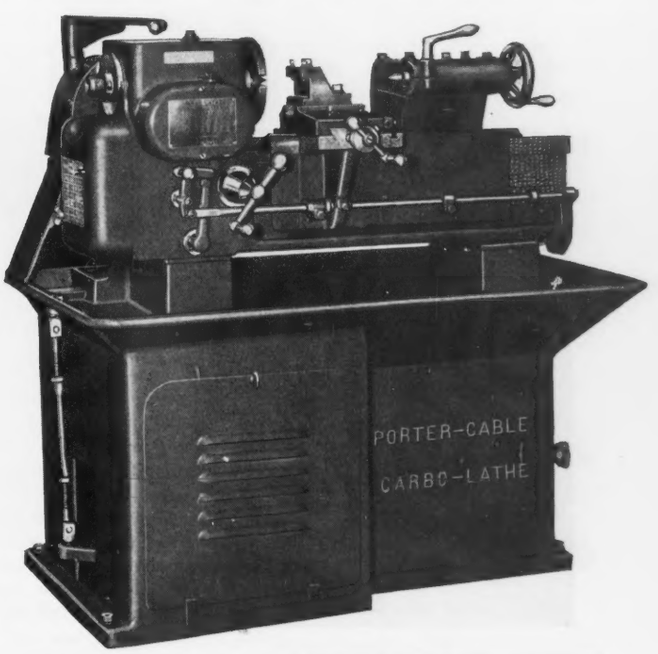
We can give you production details on interesting jobs—we will be glad to give you conservative estimates on your work. There's a PROFITABLE news story for every plant in the right CARBO-LATHE set-up.

Straight and taper turning lathe spindle. 2 Shoulders—225 R.P.M. Surface F.P.M. — 160. Feed .010″. Production —18 per hour.

Socket — turning long shank. Spindle speed —970 R.P.M.; Surface F.P.M.— 200; Feed — .020″. Production 120 pieces per hour.

CARBO-LATHES

Spindle speeds to 2,000 R.P.M.; smooth worm gear drive; 18 Timken and anti-friction bearings; capacity for work within 12″ by 18″. Send for complete details.



CARBO-LATHE

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Machine Tool Builders for 26 Years

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Dean Machinery Co., Chicago, Ill.
K. O. Ditmars, Philadelphia, Pa.
Harron, Rickard & McCone Co., San Francisco, Calif.
Herberts Mchy. Co., Ltd., Los Angeles, Calif.
Lynd-Farquhar Co., Boston, Mass.
Joseph Monahan, Grand Rapids, Mich.
Northern Mchy. & Supply Co., Minneapolis, Minn.
Joseph F. Pflum, Cincinnati, Ohio
Strong, Carlisle & Hammond, Detroit, Mich.
Strong, Carlisle & Hammond, Cleveland, Ohio
C. B. Niver, Toledo, Ohio
Vandyck-Churchill Co., New York City—New Haven, Ct.
Canadian Fairbanks-Morse Co., Ltd. Toronto, Ont.
Williams & Wilson, Ltd., Montreal, Canada

Foreign Representatives

Fenwick Freres & Co., Paris, France
R. S. Stokvis & Zonen, Rotterdam, Holland
Bohm & Bormann, Berlin, Germany
Swiss Mchy. Import Co., Ltd., Zurich, Switzerland.
E. P. Bevan & Son, Pty., Ltd., Melbourne, Australia
Machine Tools-India, Ltd., Calcutta, India
Ing. A. Brichts, Prague, Czechoslovakia
Massing & Ingham, Pty., Ltd., Johannesburg, So. Africa

Hoist Manufacturers Association at the seventeenth annual meeting of the Association, held at Washington, D. C., April 2.

STREINE TOOL & MFG. CO., New Bremen, Ohio, has acquired the manufacturing rights to the Wahlert self-cleaning automatic roll polishers, which have been in successful operation for over two years in the plant of a well-known steel company. This company has about fifteen sheet and tin mills equipped with these polishers.

EARL C. SMITH, chief metallurgist of the Republic Steel Corporation, Youngstown, Ohio, addressed the Detroit Chapter of the American Society for Metals at Detroit, April 9, on the subject "What the Steel-makers are Doing for the Consumer."

A. C. RICHARDSON has been appointed a member of the technical staff of the Battelle Memorial Institute, Columbus, Ohio. Mr. Richardson was formerly with the Bureau of Mines at its Southern Experiment Station in Tuscaloosa, Ala.

OBITUARIES

Frederick A. Geier

The machine tool industry of the United States lost one of its leaders through the sudden death of Frederick A. Geier, president of the Cincinnati Milling Machine Co. and the Cincinnati Grinders, Inc., Cincinnati, Ohio, who passed away following a heart attack in his home March 27, at the age of sixty-seven years.

Mr. Geier was born in Cincinnati. He graduated from the Woodward High School there in 1884, and in 1887, became associated with the Cincinnati Screw & Tap Co., which, in 1889, became the Cincinnati Milling Machine Co. From that time on, his main business interests were connected with this company, of which he was the president for many years. He saw that company grow from a comparatively small enterprise to one of the leading machine tool manufacturing establishments in the world, a growth universally acknowledged as due to his able leadership.

Frederick A. Geier

In 1921, his company acquired the Cincinnati Grinding Machine Co. which was incorporated under the name, The Cincinnati Grinders Inc., and this company also, under his guidance has established itself as a most important factor in the grinding machinery business. He was also the head of the Modern Foundry Co., a firm allied with the other two companies.

While these three companies operated directly under Mr. Geier's guidance, his business interests covered a still broader field. He was president of the Factory Power Co. and the Cincinnati Rubber Mfg. Co. He was also president of the Cincinnati Morris Plan Bank and a director in half a dozen other banks and manufacturing and realty companies.

One might have thought that a man with such wide business interests would find little time for civic, educational, and philanthropic enterprises. On the contrary, his activities in these fields were unusually broad and diversified. He was chairman of the Council of Social Agencies of Cincinnati from 1913 to 1915, and chairman of the Central Budget Committee from 1915 to 1917. He was also a member of the executive committee of the Community Chest from 1917 to the time of his death, and chairman of the board of directors of the Children's Home.

His interest in education centered chiefly in engineering and vocational training. At one time he was a trustee of the University of Cincinnati and worked with Dean Schneider in developing cooperative courses in engineering at the University. He aided and supported the Cincinnati Board of Education in its vocational training plans. At the time of his death he was president of the Ohio Mechanics' Institute.

Mr. Geier also took an active part in civic affairs, and worked untiringly for improved conditions in municipal government. He was an advocate of non-partisan municipal government; and as early as 1907, he was a member of the City Party Committee, which placed a non-partisan municipal ticket on the ballot in Cincinnati.

His interest and activity in the organizations of the industry to which he belonged are well known. He assisted in the organization of the National Metal Trades Association, and was one of the early supporters of the National Machine Tool Builders' Association, of which he was president in 1910 and 1911. He was also a member of the American Society of Mechanical Engineers, the Society for the Promotion of Industrial Education, the Chamber of Commerce of the United States, and numerous local engineering and commercial societies and clubs.

Mr. Geier is survived by his widow, Mrs. Julia Geier; two sons, Fred V. Geier, vice-president and general manager of the Cincinnati Milling Machine Co., and Paul, a student at Harvard University; two daughters, Mrs. Gilbert McCurdy of Rochester, N. Y., and Mrs. Henry V. Flynt of Greenwich, Conn.; three brothers, Walter H. Geier, Philip O. Geier, and Otto P. Geier; and two sisters, Miss Norma Elizabeth Geier and Mrs. J. H. Cone, all of Cincinnati.

Alton Farrel

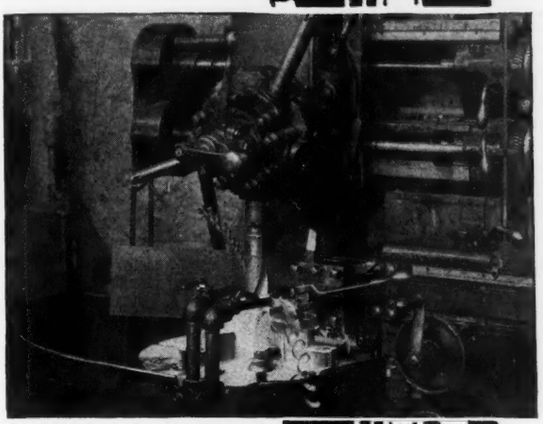
Alton Farrel, for thirty years a director and treasurer of the Farrel-Birmingham Co., Inc., Ansonia, Conn., died March 28 at his home 367 Prospect St., New Haven, Conn., after an illness that had caused his retirement from active business over a year ago. Mr. Farrel was born in Ansonia, August 22, 1879. He was the son of Alton Farrel and the grandson of Franklin Farrel, founder of the Farrel Foundry & Machine Co. After graduating from Yale University in 1902, he entered the employ of the Farrel organization, which he served in various capacities during the remainder of his life. Mr. Farrel was a director in a number of financial, industrial, and public utility corporations, and took an active interest in civic and public affairs. At one time he was a member of the Connecticut General Assembly and a State Senator.

E. H. BRUNER, secretary of the Chicago Wheel & Mfg. Co., Chicago, Ill., died early in April, at the age of sixty-one.

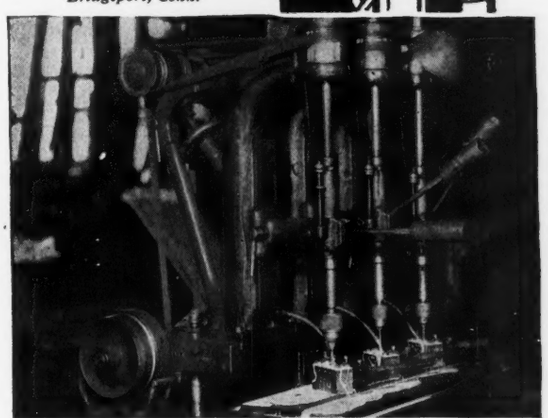
Alton Farrel

DRILL MORE HOLES PER GRIND

with Sunoco!



MACHINE: Bullard Vertical Turret Lathe.
MATERIAL: 3135 Steel.
DRILL: 2¼ in., 70 R.P.M.
LUBRICANT: 1 part Sunoco to 20 parts water.
Courtesy of **The Bullard Co.** *Bridgeport, Conn.*



MACHINE: Leland - Gifford High Speed Drill Press.
MATERIAL: Bolt Steel.
DRILL: No. 3; 644 R.P.M.
LUBRICANT: 1 part Sunoco to 15 parts water.
Courtesy of **Canadian Line Materials, Ltd.** *Scarborough Junction, Ont. Canada*

THE drilling of metals is so often regarded as such a simple operation that it may be overlooked as an important factor in costs.

Actual performance records of Sunoco Emulsifying Cutting Oil prove that it definitely helps give greater production, greater accuracy and lower production costs in the drilling operations.

Drills Cut Faster

When Sunoco is the cutting oil utilized, you will find drills cut faster and produce more holes per grind.

The lubricating and cooling properties of this cutting oil aid drills in cutting true cylindrical holes of accurate size. Reaming and spoilage are reduced or eliminated.

No Clogging or Burning

Long drill life and low power costs go hand in hand with the use of Sunoco because drills clear easily, and do not clog, bind, chatter or burn.

You will find, by test, that Sunoco clearly qualifies for your drilling operations! Write now for details on Sunoco . . . and remember that the services of our experienced cutting oil engineers are at your disposal.

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Mr. Bruner became associated with Henry E. Miller, founder and present directing head of the Chicago Wheel & Engineering Co. in 1896. Four years later, he was taken into the firm and appointed secretary, a position held by him until the time of his death.

James C. Carlton

James C. Carlton, better known in industry as Jim Carlton, died March 17 at the Lankenau Hospital, Philadelphia, Pa., after a brief illness, at the age of forty-eight years. He was born in Cincinnati, Ohio, a brother of Jack C. Carlton who is now president and general manager of the Carlton Machine Tool Co. of that city. After having been educated in the Cincinnati public schools, Jim Carlton learned the machinist trade in the shops of the American Tool Works, the Bickford Machine Tool Co., and the Lodge & Shipley Machine Tool Co. Later he went with the Electric Railway Equipment Co., where he became assistant general manager.

In 1919, he began selling machine tools for the Thompson Machinery Co. of Pittsburgh, Pa. In 1921 he became associated with the Sherritt & Stoer Machinery Co. of Philadelphia, taking charge of the York territory, where he had made his home ever since. When the Sherritt & Stoer Machinery Co. became the Stoer Machinery Co., he continued his connection until December, 1926, when he became vice-president and general manager of the then organized Calco Machinery Co., in which capacity he remained until the time of his death.

Mr. Carlton had the reputation of being one of the best informed machine tool salesmen in the country, having a thorough practical knowledge of all metal-working machinery and the ability to demonstrate any machine that he sold. He read a great deal and kept pace with all new and improved methods.

COMING EVENTS

MAY 3-4—Annual meeting of the American Gear Manufacturers Association at the Penn-Lincoln Hotel, Wilkinsburg, Pa. J. C. McQuiston, manager-secretary, Room 221, Penn-Lincoln Hotel, Wilkinsburg, Pa.

JUNE 11-14—Convention of the American Electro-Platers' Society at Detroit, Mich.; headquarters, Hotel Statler. Secretary-treasurer, T. C. Eichstaedt, Hotel Statler, Detroit, Mich.

JUNE 17-22—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS to be held at Saranac Inn, Lake Saranac, N. Y. John A. C. Warner, general manager, 29 W. 39th St., New York City.

JUNE 25-28—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Denver, Colo., with headquarters at the Cosmopolitan Hotel. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 25-29—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia.

JULY 3-9—FOURTH INTERNATIONAL CONGRESS FOR APPLIED MECHANICS to be held at Cambridge, England. For detailed information, address Applied Mechanics Division, American Society of Mechanical Engineers, 29 W. 39th St., New York.

OCTOBER 1-5—NATIONAL METAL CONGRESS AND EXPOSITION, Commerce Hall, Port of Authority Bldg., New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, director.

OCTOBER 1-5—Annual convention of the AMERICAN SOCIETY FOR METALS (formerly the American Society for Steel Treating), New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, secretary.

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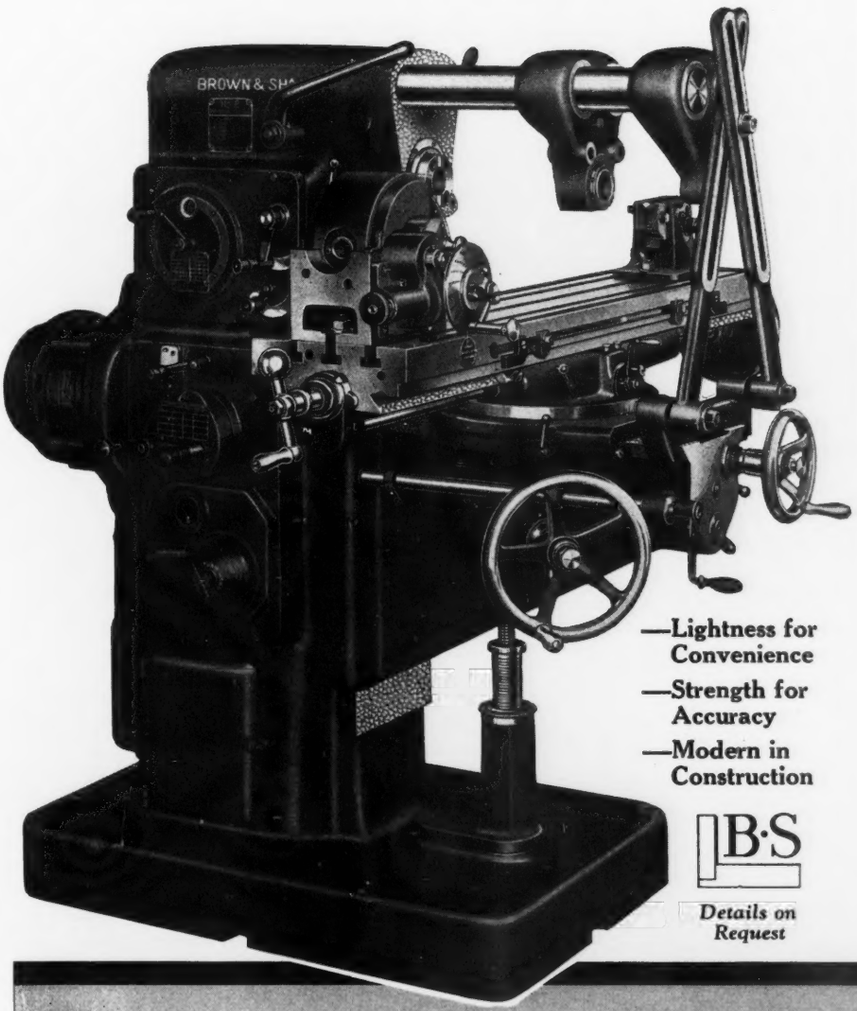
It will pay you to check the important features of this New Design before buying equipment for your lighter class of milling



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—Strength for Accuracy

—Modern in Construction

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Details on Request

- ✓ Lightness and Convenience for Easy Handling—Rigid for Accurate Work.
- ✓ Convenient Height for Vision and Handling Work.
- ✓ Motor Runs Only When Machine Runs—Brake for Quick Stopping.
- ✓ Automatic Lubrication in Column with Filtered Oil.
- ✓ Wide Range of Speeds in Two Series—40 to 1300 R.P.M.
- ✓ Convenient Single Lever Feed Control—16 changes, ½" to 18¼" per minute.
- ✓ Flanged Type Motor Drive with Enclosed Wiring.
- ✓ "Set-Back" Column Face Gives Added Clearance For Work—Permits Placing Cutters Nearer to Spindle Nose.
- ✓ Arranged for Handling Either Universal Milling Attachment or Slotting Attachment by Crane.
- ✓ Arranged for Obtaining Unusually Short Leads by Short Lead Attachment and Regular Spiral Index Centers.
- ✓ Modern in Construction—All Heat-Treated, Alloy Steel Gear Drive in Column—Ground Tooth Gears in Speed Train—All Shafts in Column Splined and Mounted on Anti-Friction Bearings.

Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

The New Brown & Sharpe No. 2 "Light Type" UNIVERSAL MILLING MACHINE

NEWS OF THE INDUSTRY

California

A. J. HOWELL has been appointed manager of the Pacific Coast district of Revere Copper & Brass, Inc., 230 Park Ave., New York City, succeeding R. H. BINNS, JR., who has moved to New York City to become assistant general sales manager. Mr. Howell has been with the Revere organization on the Pacific Coast since the opening of an office there in 1932, and for many years previously represented the Rome division of the company on the coast. He will have his office in the Russ Building, San Francisco, Calif. Branch sales offices for this district are maintained in Los Angeles and Seattle.

Illinois and Wisconsin

FOOTE BROS. GEAR & MACHINE CO., 5301 S. Western Blvd., Chicago, Ill., has appointed the following representatives: F. A. EMMONS, JR., will have charge of one of the new Chicago territories; A. C. HANSON, New Buffalo, Mich., will cover the northern half of Indiana with the exception of Lake County; southern Indiana is now handled by J. E. HARLOW, 49 Richmond St., Dayton, Ohio; J. H. NICHOLSON, 6315 N. 33rd St., Omaha, Neb., will handle all of Nebraska and the two western lines of counties in Iowa; JOHN M. DAVIS, U. S. National Bank Bldg., Denver, Colo., replaces the URQUHART SERVICE CO. in Colorado and Wyoming; S. D. CALLOWAY, 3029 Roanoke Road, Kansas City, Mo., replaces the NOELLING STEEL SALES CO. in the state of Kansas; R. K. PLUMMER, 4015 Navahoe Road, Cleveland, Ohio, formerly assistant sales manager of Gears & Forgings, Inc., is taking the place of C. W. FRIZZELLE in the northern half of Ohio.

AMERICAN MACHINERY AND TOOLS INSTITUTE, 40 N. Wells St., Chicago, Ill., at its annual meeting in April elected the following officers and directors: President, E. G. Todt, E. G. Todt Co., Chicago; vice-president, Rudolph Krasberg, R. Krasberg & Sons Mfg. Co., Chicago; treasurer, Craig B. Hazelwood, First National Bank, Chicago; secretary, George R. Tuthill, 40 N. Wells St., Chicago; directors, E. R. Prout, Teletype Corporation, Chicago; J. S. Kozacka, Lewis Institute, Chicago; F. B. Coyle, International Nickel Co., Inc., New York City; A. C. Wais, Niles Tool Works Co., Chicago; and J. Gordon Barr, Morse Twist Drill & Machine Co., Chicago.

INVENTIONS DIGEST, INC., 310 S. Michigan Ave., Chicago, Ill., has been organized to offer manufacturers a new service, advising them month by month of the progress and availability of new inventions in their field. The company collects descriptions of recent inventions from patent attorneys and reports news of these inventions to manufacturers. Subsequent negotiations for sale or licensing are handled directly between the manufacturer and the inventor's attorney. Those interested can obtain a pamphlet giving complete details of this service.

STEPHENS-ADAMSON MFG. CO., Aurora, Ill., manufacturer of conveying equipment, has reopened sales-engineering offices at Pittsburgh, Pa., and Huntington, W. Va. The Pittsburgh office is located at 1206 Gulf Bldg. and is under the supervision of HARRY W. BANBURY, who has long been associated with the firm as purchasing agent and special sales engineer. The Huntington sales and engineering will be handled by D. W. ALLEN.

R. C. INGERSOLL, president of the Ingersoll Steel & Disc Co., Chicago, Ill., sailed on the *Europa*, April 29, for a six weeks' business trip to France, Germany, and England. While abroad Mr. Ingersoll plans to make contact with the automotive manufacturers and automotive parts makers regarding various equipment items, particularly in relation to the use of tapered truck wheel disks.

ERRINGTON MECHANICAL LABORATORY, 24 Norwood Ave., Stapleton, N. Y., announces that the Chicago office has been moved from 549 W. Washington Blvd. to 6047 N. Tallman Ave.

CHAIN BELT CO., Milwaukee, Wis., has reopened its office in Houston, Tex., under the direction of J. W. SNAVELY. The office is located at 3118 Harrisburg Blvd. and the post office address is P.O. Box 1812, Houston.

New England

FRANK CARY has joined the sales engineering organization of the Austin-Hastings Co., Inc., ParKett Machinery Division, 226 Binney St., Kendall Square, Cambridge, Mass. Mr. Cary will make his headquarters in Hartford, Conn., handling the sale of metal-working machinery and machine tools in the state of Connecticut and western Massachusetts.

PATTERSON FOUNDRY & MACHINE CO., East Liverpool, Ohio, announces the appointment of WILLIAM SOHERR as manager of the New England territory, with headquarters at Boston, Mass.

New York and New Jersey

AMTHOR TESTING INSTRUMENT CO., manufacturer of speed recorders and testing instruments for paper, cordage, and light metals, has moved from 309 Johnson St., to 4-10 Leo Place, Brooklyn, N. Y. The new plant combines office, showroom, and factory on one floor, and provides more complete facilities for handling increasing business.

JOHN D. LOCKTON was elected assistant treasurer of the General Electric Co., Schenectady, N. Y., at the last meeting of the board of directors.

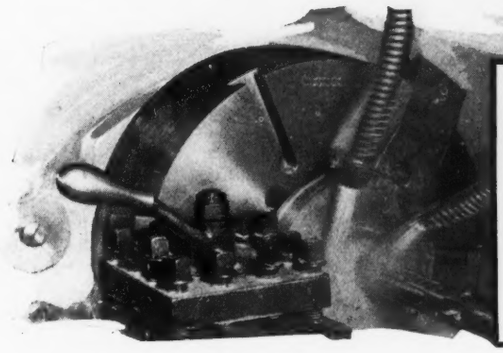
O. B. J. FRASER and J. S. VANICK, of the Research Department of the International Nickel Co., Inc., New York, presented a paper before the American Petroleum Institute at its meeting in Pittsburgh, Pa., May 23, on the use of alloy cast irons in oil-production equipment. The effects of nickel additions were discussed in detail, and the use of quenching and drawing treatments to obtain a hard iron for resistance to abrasion and wear was also dealt with.

WILLIAM E. SYKES, of the Farrel-Birmingham Co., Inc., Buffalo, N. Y., has been awarded the Edward Longstreth Medal by the Franklin Institute, Philadelphia, Pa., "in consideration of the design and development of the Sykes gear generators." The presentation was made at Philadelphia on May 16.

William E. Sykes, Who was Recently Awarded the Edward Longstreth Medal

Mr. Sykes was born in Great Britain in 1883. In 1911, while chief engineer and factory manager of the Power Plant Co., Ltd., West Drayton, England, he developed the first gear generator that bears his name and for which he is now being honored. In 1922, he came to the United States and became connected with the Farrel-Birmingham Co. At the Buffalo plant of this company, he has since that time designed and supervised the building of gear generators, speed

AN AID TO SECURING FULL CAPACITY OF LATHES



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DEEPER CUTS
HIGHER SPEEDS
are made possible

COMPLETE flexibility, fast metal-removing capacity and ease of operation are embodied in the modern turret lathe. It is a profitable unit for rapid, accurate production of duplicate work, yet gives flexible utility when the machining of a single part is necessary.

SUNOCO Assures Dependable Lathe Performance

Proper tool equipment and its efficient arrangement are necessary in lathe operation, but the cutting lubricant is likewise a vital factor.

With Sunoco Emulsifying Cutting Oil, tool steel, carboloy and tantalum carbide small tools can take deep cuts at surface speeds that utilize the full capacity of the lathe.

Lathe Operators Like SUNOCO

Operators appreciate the advantages of Sunoco . . . it permits increased machine speed, longer runs per tool grind, less lost time in setting up, greater accuracy, better finish and fewer rejects throughout a long run.

It will pay you to get the facts on Sunoco and to test it in your plant. Your correspondence is invited . . . and the services of our cutting oil engineers—of wide experience—are at your disposal.

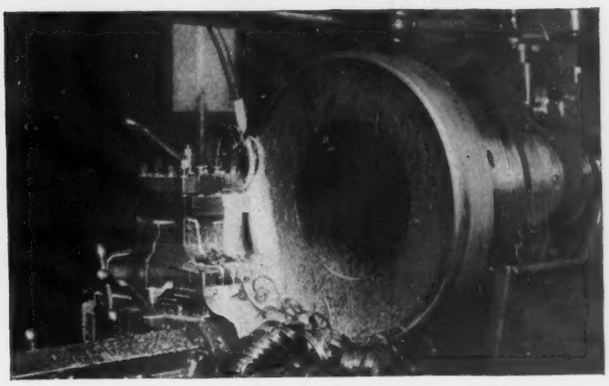
Operation: Turning and drilling gear cluster.
Machine: Warner & Swasey 3-A Turret Lathe.
Material: S. A. E. 1020.
Turning: 160 S. F. P. M.
Drilling: 90 S. F. P. M.
Lubricant: 1 part Sunoco to 15 parts water.

Courtesy of
Warner & Swasey Co.
Cleveland

SUNOCO
EMULSIFYING CUTTING OIL

Operation: Turning and facing Bull Gear.
Machine: Warner & Swasey 5-A Turret Lathe.
Material: Manganese Steel Casting.
Facing: 140 S. F. P. M.
Lubricant: 1 part Sunoco to 15 parts water

Courtesy of
Warner & Swasey Co.
Cleveland



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reducers, mill drives, and airplane-engine dynamometers. He has also developed a gear-tooth comparator and other gear-inspection devices.

BAKELITE CORPORATION, Bound Brook, N. J., held a two-day sales conference at Montclair, N. J., May 1 and 2. The first day was devoted to business sessions, and the second to an outing and banquet attended by 125 executives and department heads. On May 9 the "old timers" (those who had been with the company more than ten years) of the Bakelite Corporation held an annual banquet at Somerville, N. J. There were more than 100 present, many of whom had been with the company over twenty years.

EDGAR N. DOLLIN has been appointed manager of the Die-casting Division of the American Type Founders Corporation, 300 Communipaw Ave., Jersey City, N. J. It is planned to expand the Die-casting Division to take in all forms of commercial die-casting.

Ohio

HARRY W. MCQUAID, of the Republic Steel Corporation, Youngstown, Ohio, spoke Monday evening, May 7, before the Cleveland Chapter of the American Society for Metals on the subject "The Relation of Steelmaking to Heat-treatment and Machineability." The remarks of Mr. McQuaid on casehardened gear steels were of especial interest because of his long experience in this field.

Mr. McQuaid also addressed a meeting of the Cincinnati, Dayton, and Columbus Chapters of the American Society for Metals in Columbus, Ohio. The subject of Mr. McQuaid's address was "Grain Size in Carburizing and Forging Steels."

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, at the last meeting of the board of directors elected the following officers: P. O. GEIER, chairman of the board and treasurer; FREDERICK V. GEIER, president; WALTER W. TANGEMAN, vice-president; and FERRIS M. ANGEVIN, secretary.

P. O. Geier, Chairman of the Board of the Cincinnati Milling Machine Co.

Frederick V. Geier, Newly Elected President of the Cincinnati Milling Machine Co.

CLYDE E. WILLIAMS has been appointed director of the Battelle Memorial Institute, Columbus, Ohio, and Dr. H. W. GILLETT has been made chief technical advisor. Both Dr. Gillett and Mr. Williams have been associated with the Institute since 1929, Dr. Gillett as director, sharing the administrative duties with Mr. Williams as associate director, and at the same time serving as metallurgical supervisor. Dr. Gillett will now devote his entire time to the scientific side of the work.

L. A. SHEA, who has been identified with the main office in charge of the electrical department of Hevi Duty Electric Co., Milwaukee, Wis., has been appointed district representative for the state of Ohio, with offices at 5005 Euclid Ave., Cleveland, Ohio. He will have charge of the company's service and sales agency on electric heat-treating furnaces.

RALPH P. BROWN, formerly in charge of publicity for the National Lime Association and the Brown Instrument Co., Philadelphia, Pa., and recently conducting an independent business paper editorial service in Cleveland, has joined the advertising department of the Timken Roller Bearing Co. and the Timken Steel & Tube Co., Canton, Ohio.

TIMKEN ROLLER BEARING CO., Canton, Ohio, reports that it has received an order from the Chicago, Milwaukee, St. Paul & Pacific Railroad, for bearings and boxes for fifty de luxe passenger coaches which this railroad will build in its Milwaukee shops.

ESCO ENGINEERING SERVICE CO., Toledo, Ohio, has appointed H. G. WILSON and P. L. KEACHIE, 614 Stephenson Bldg., Detroit, Mich., special representatives for the sale of Esco drill fixtures in the Detroit, Pontiac, and Flint territories.

ARTHUR E. SCHNELL, for the last two years supervisor of the valve department of Aluminum Industries, Inc., Cincinnati, Ohio, manufacturer of Permite products, has been promoted to the position of plant superintendent.

Pennsylvania

S K F INDUSTRIES, INC., announces that the executive offices of the corporation, after having been located twenty years in New York City, have been consolidated with the company's Philadelphia plant at Front St. and Erie Ave. in that city. The executive, sales, engineering, research, and production departments are thus consolidated into one unified organization. The S K F Industries, Inc., is part of a world-wide organization maintaining six research laboratories, fifteen plants, and two hundred and fifty factory branch offices throughout the world. This organization employs, in total, 23,000 people, speaking twenty-eight languages. The ore for the steel from which its products are made comes from its own mines, and the steel is made in its own mills. Even the charcoal used in processing the special steels comes from its own forests.

GEORGE H. BUCHER was elected president of the Westinghouse Electric International Co., East Pittsburgh, Pa., at a recent meeting of the company. As president and general manager of the company, he will continue his headquarters in East Pittsburgh. Mr. Bucher has been connected with the Westinghouse organization since 1909. Previous to his present connection, he served as vice-president and general manager of the Westinghouse Electric International Co.

MITCHELL SPECIALTY CO., Holmesburg, Philadelphia, Pa., has recently installed modern rolling machines and is now engaged in the manufacture of a general line of metal moldings and shapes. A. R. EVANS, formerly with the Edward G. Budd Mfg. Co. of Philadelphia, is in charge of sales.

R. B. MILDON has been elected vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., in charge of the operations of marketing, engineering, manufacturing, and service having to do with the products of the South Philadelphia Works, where he will be located.

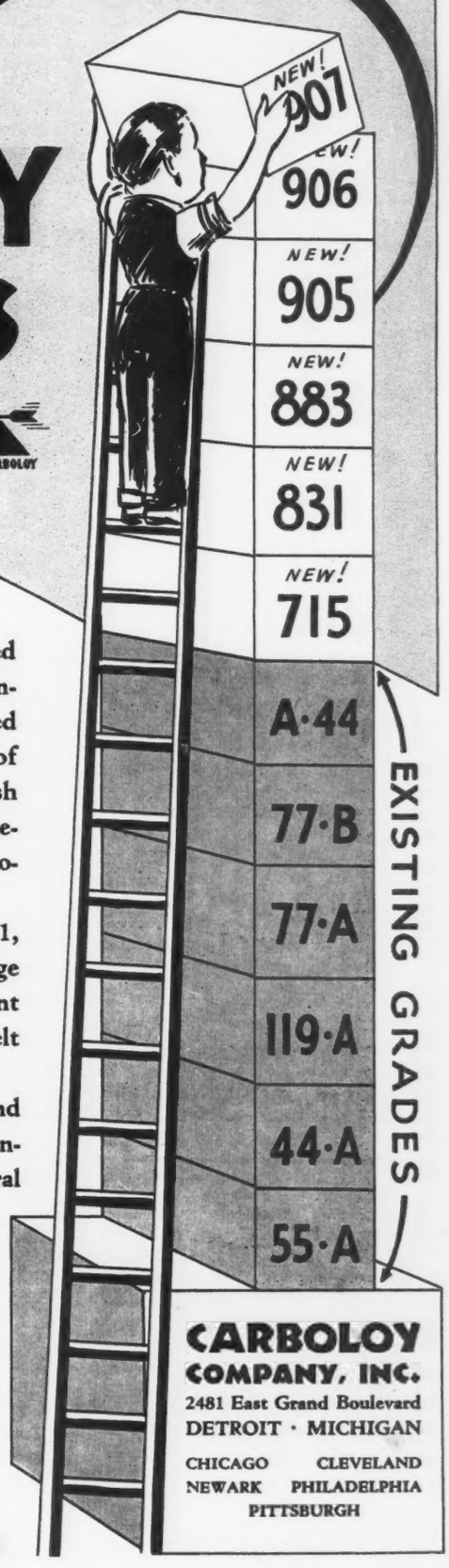
C. M. HAMERSLY has been appointed vice-president and general manager of the Calco Machinery Co., Philadelphia, Pa., succeeding the late James C. Carlton. Miss A. P. MCDONALD, formerly assistant treasurer, is now treasurer of the company.

D. J. NORMOYLE, 1323 W. Tioga St., Philadelphia, Pa., announces that he no longer represents the Hanson-Whitney Machine Co., Hartford, Conn., in the Philadelphia territory. Mr. Normoyle has handled this line for the last thirteen years.

Announcing 6 NEW CARBOLOY GRADES

REG. U.S. PAT. OFF.

A wide Range of Grades now available to meet your Exact Requirements



TO supplement the six existing grades of Carboloy cemented carbides, which have proved adequate for general machining work, we now release six additional grades developed primarily to obtain improved performance in special fields of application. Among these applications are the rough and finish boring, finish turning and facing of steel brake drums, single-point finish boring of steel connecting rods, re-boring automotive cylinders, and turning-facing-boring piston rings.

The release of these six new grades, designated as 715, 831, 883, 905, 906, 907—is but the initial part of a long-range program which has for its ultimate objective the development of special grades for each field of application in which it is felt that improved results can be obtained.

To further this program we maintain our own research and developmental facilities and also have at our disposal the extensive facilities of the Research Laboratories of the General Electric Co., of which we are a subsidiary.

The 12 grades of Carboloy cemented carbide now available will be found adequate to give you a high order of results on all of your present machining applications within the existing range of cemented carbide use. We will, however, continue to develop special grades for fields of application where it may be indicated that improved results can be obtained.

CARBOLOY COMPANY, INC.
2481 East Grand Boulevard
DETROIT · MICHIGAN

CHICAGO CLEVELAND
NEWARK PHILADELPHIA
PITTSBURGH

NEW BOOKS AND PUBLICATIONS

IMPACT TESTING OF CAST IRON. 51 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price, 50 cents.

This extensive report on the usefulness of the several forms of impact test as applied to cast iron contains one of the most comprehensive series of data ever assembled on the physical properties of this material. The research work, extending over a period of three years, and the correlation of data were handled by Subcommittee XV on Impact Testing, of the A. S. T. M. Committee A-3 on Cast Iron.

Some 500 test bars were specially cast, machined, and tested by the several methods investigated, on the various types of machines commercially in use. Extensive tables give the results of the transverse, tension, fatigue, compression, and shear tests which were made, and by the use of charts and illustrations, these data are condensed in convenient form.

FIFTY REPORTS ON MECHANICAL POWER TRANSMISSION FROM MOTOR DRIVE TO INDUSTRY. By Robert W. Drake. 226 pages, 8 1/2 by 11 inches. Published by the American Leather Belting Association, 41 Park Row, New York.

This book is the result of an investigation made over a period of three years on the transmission of mechanical power from electric motor to driven machine by belting, chains, and gears. The problem is considered from the standpoint of design, maintenance, trouble elimination, comparative production, and comparative costs under a wide range of conditions and applications. The book covers the entire subject of individual motor drives and modern group drives, showing that some combination of both systems is needed in most plants and pointing out the cost savings that can be effected.

PROCEDURE HANDBOOK OF ARC-WELDING DESIGN AND PRACTICE. 450 pages. 5 3/4 by 9 inches. Published by the Lincoln Electric Co., Cleveland, Ohio. Price, $1.50.

This is a revised and enlarged edition of a handbook on arc welding. The eight principal sections deal with various phases of arc welding in a simple, concise manner. They cover practically every use and application of arc welding. Among the additional features included in the new edition are the following: Weld inspection; study of stress distribution by means of polarized light; simplified design of arc-welded machinery; procedure and speeds for arc-welding aluminum; technique and speeds for welding of copper; and construction of welded water lines. Data on estimating welding costs are included.

SOME ESSENTIALS OF INDUSTRIAL RECOVERY. By George H. Houston, president, Baldwin Locomotive Works. 16 pages, 6 by 9 inches. Published by the Baldwin Locomotive Works, Philadelphia, Pa.

SPECIAL SLIDE-RULES. By J. N. Arnold. 42 pages, 6 by 9 inches. Published by Purdue University, Lafayette, Ind., as Extension Series No. 32 of the Engineering Extension Dept.

COMING EVENTS

JUNE 11-14—Convention of the AMERICAN ELECTRO-PLATERS' SOCIETY at Detroit, Mich.; headquarters, Hotel Statler. Secretary-treasurer, T. C. Eichstaedt, Hotel Statler, Detroit, Mich.

JUNE 17-22—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS to be held at Saranac Inn, Lake Saranac, N. Y. John A. C. Warner, general manager, 29 W. 39th St., New York City.

JUNE 19-21—NATIONAL CONFERENCE AND EXHIBITION ON LABORATORY USES OF MODELS IN STRUCTURES AND HYDRAULICS at Cornell University, Ithaca, N. Y. Professor Fred L. Plummer, Case School of Applied Science, Cleveland, Ohio, general chairman in charge of arrangements.

JUNE 25-28—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Denver, Colo., with headquarters at the Cosmopolitan Hotel. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 25-29—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia.

JULY 3-9—FOURTH INTERNATIONAL CONGRESS FOR APPLIED MECHANICS to be held at Cambridge, England. For detailed information, address Applied Mechanics Division, American Society of Mechanical Engineers, 29 W. 39th St., New York.

OCTOBER 1-5—NATIONAL METAL CONGRESS AND EXPOSITION, Commerce Hall, Port of Authority Bldg., New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, director.

OCTOBER 1-5—Annual convention of the AMERICAN SOCIETY FOR METALS (formerly the American Society for Steel Treating), New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, secretary.

OCTOBER 22-26—Annual meeting of the AMERICAN FOUNDRYMEN'S ASSOCIATION and Fifth International Foundry Congress and Exposition in the New Auditorium, Philadelphia, Pa. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

DECEMBER 3-7—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York.

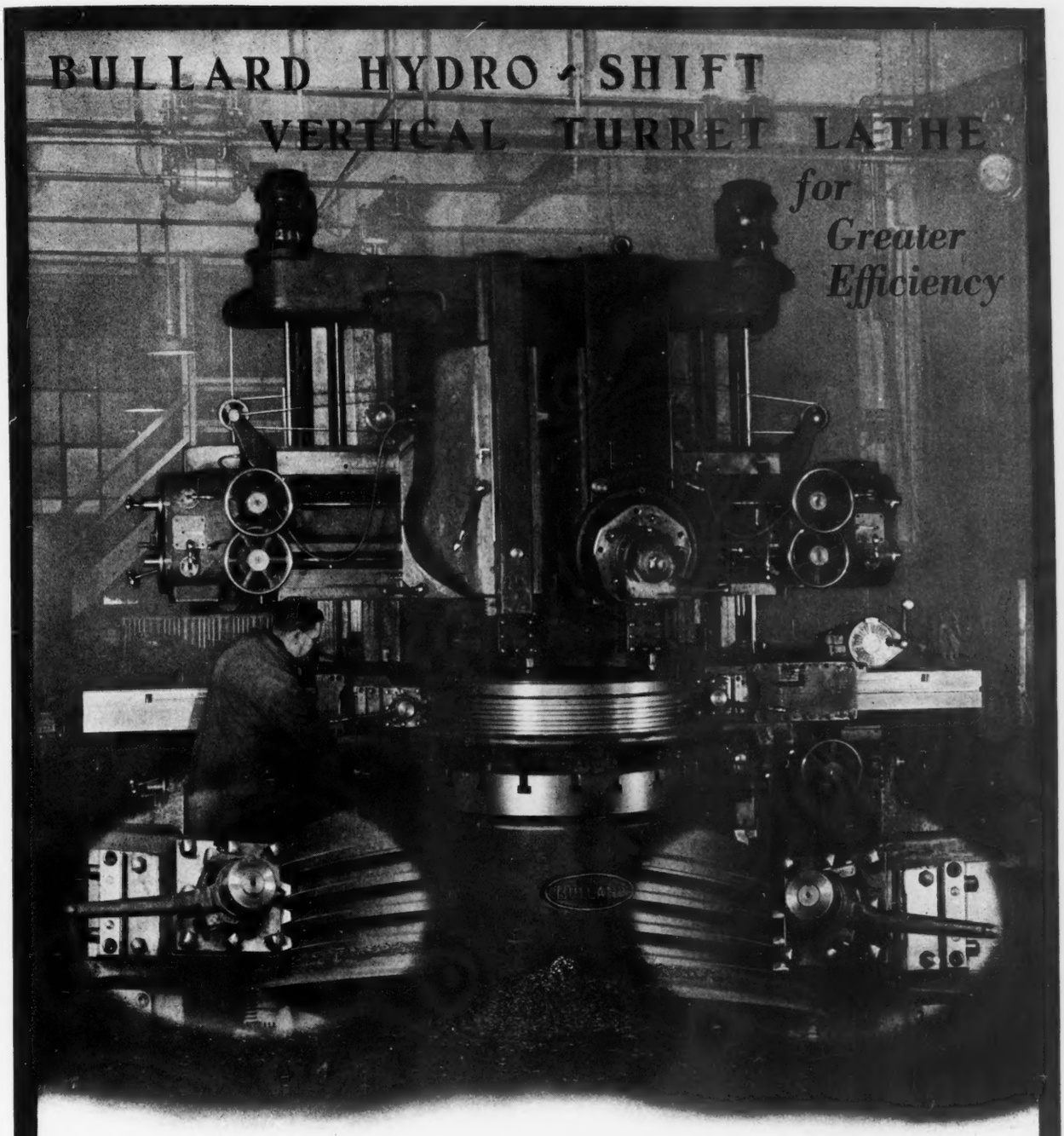
DECEMBER 3-8—ELEVENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York City. Manager Charles F. Roth, International Exposition Co., Grand Central Palace.

OBITUARIES

FRED DOEPKE, founder and president of the Wrought Washer Mfg. Co., Milwaukee, Wis., died in Los Angeles, Calif., on April 23, at the age of seventy-two years. Mr. Doepke was born at Rockford, Ill., and at an early age went with his parents to Milwaukee, where he received his early education. His first mechanical training was gained in the shops of the old Filer & Stowell Co. Later he traveled through the East, working in various cities. During these travels, he became interested in automatic machinery, and conceived the idea of automatic washer making machinery. Returning to Milwaukee in 1887, he founded the present Wrought Washer Mfg. Co. He was a member of the American Society of Mechanical Engineers and secretary of the committee on the standardization of plain and lock washers. He was also a past vice-president of the Engineering Society of Milwaukee.

FRANK W. ADAMS, JR., who was connected with the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., died at his home in Dayton, Ohio, on April 21. Mr. Adams had been a representative for the Ex-Cell-O organization, including the Continental and Krueger-Wayne Divisions, in the Dayton territory for several years.

BULLARD HYDRO-SHIFT VERTICAL TURRET LATHE *for Greater Efficiency*



Two vertical heads for finish facing or other finishing operations while simultaneously two side heads are grooving provides Four Head machining Efficiency.

The work illustrated:

Cast Iron

56 inches in diameter.
Finish facing across top.
Grooving operation to 7/8-inch depth rough and finish cuts.
Time—19 minutes.

Bridgeport **THE BULLARD COMPANY** Connecticut

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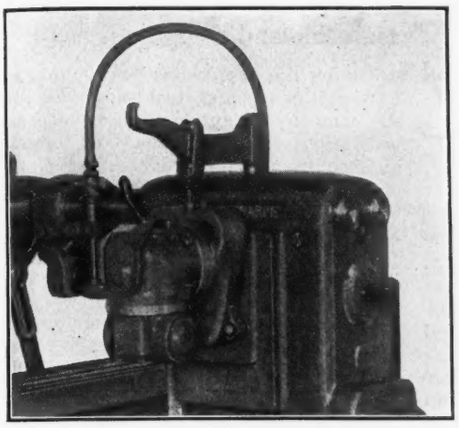
Your Progress Depends Upon Your Knowledge of Your Industry



When not in use attachment is swung to side of machine and if desired can be bolted to finished pad provided.

An Added Feature~

for the No. 2 "Light Type"

. . . More Convenient Arrangement
. . . Improved Operating Efficiency

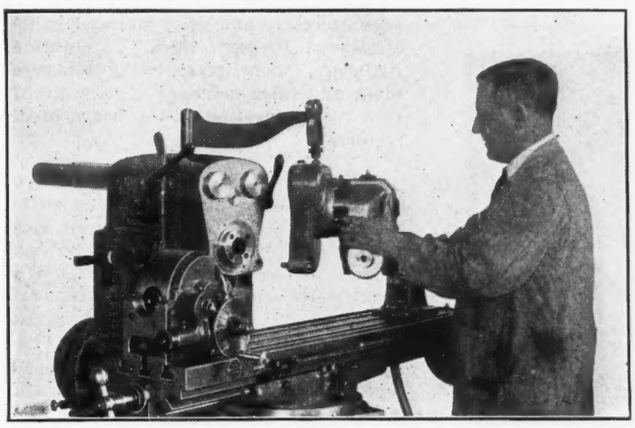
~ the UNIVERSAL MILLING ATTACHMENT with CRANE

—further increasing the usefulness of this new machine for the lighter class of milling

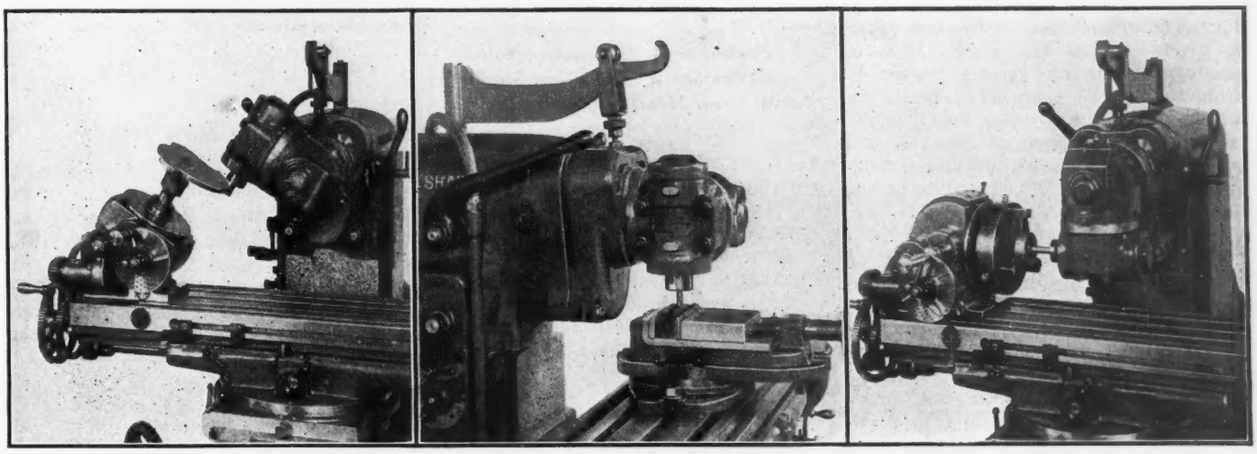
— Details on request —

Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A.

B·S



Bringing attachment into position for use is very simple —just swing attachment around to front as shown— clamp to overarms and to face of column.



The convenience of the crane in holding attachment for location on face of column can be appreciated from the views above. Note also the convenience of the attachment for setting in any position and the unobstructed view of work as well as ample clearances obtained in this design. View at right shows Universal Milling Attachment used in conjunction with Short Lead Attachment cutting internal thread.

The New Brown & Sharpe No. 2 "Light Type" UNIVERSAL MILLING MACHINE

NEWS OF THE INDUSTRY

California

SETH H. TAYLOR, JR., who has been closely identified with the welding industry for the last seven years, has been appointed Pacific Coast manager of the Lincoln Electric Co., Cleveland, Ohio. Mr. Taylor will make his headquarters at San Francisco, Calif. For the last four years he has had charge of the Los Angeles office of the company and previous to that he spent considerable time at the Cleveland headquarters, where he was engaged in research and the development of applications of production welding.

FEDERATED SALES SERVICE, 537 Commonwealth Ave., Boston, Mass., announces the appointment of ANDREW M. PETERSON as California representative, with headquarters at 210 W. 7th St., Los Angeles.

Illinois

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill., have recently made an addition to their plant at St. Louis, Mo., which will provide greatly increased facilities for storing and dispatching steel and allied products for the St. Louis area. Approximately 40,000 square feet of floor space has been added by extending one of the large spans 165 feet and erecting a new building. The greater part of the new space is given over to the warehousing of products requiring special protection from atmospheric changes. A circulating warm air heating system provides the necessary distribution of heat for the proper storing of sheets, tool steels, welding rod, cold finished bars, bands, hoops, and other high-grade steels.

R. S. ARCHER has joined the staff of the Republic Steel Corporation, Youngstown, Ohio, as chief metallurgist of the Chicago district. E. LARNED remains assistant chief metallurgist of that district. Mr. Archer was previously director of metallurgy of the A. O. Smith Corporation, Milwaukee, Wis., and prior to that, was in charge of the Cleveland section of the Aluminum Research Laboratories of the Aluminum Co. of America.

R. C. MAHON Co., Detroit, Mich., manufacturer of permanent building products and special industrial equipment, including spray booths, blow-pipe systems, ovens, and ventilating equipment, has established a sales-engineering office in Chicago at 231 S. LaSalle St. WALTER F. SHEETZ, vice-president of the company, will have charge of the new office.

FREDERICK B. HEITKAMP, general sales manager of the Cincinnati Milling Machine Co. and Cincinnati Grinders Inc., has resigned to become a member of the executive staff of Lyon Metal Products, Inc., Aurora, Ill., manufacturer of steel lockers, steel office furniture, and similar metal equipment. He will assume his new duties July 1. Mr. Heitkamp graduated from Rutgers University in 1917, and in 1921 became associated with the Cincinnati Milling Machine Co. as assistant advertising manager, having since that time held the positions of advertising manager, sales manager, and general sales manager. Mr. Heitkamp's associates at the Cincinnati Milling Machine Co. gave him a farewell testimonial luncheon at the Cincinnati Country Club on June 16, at which time he was presented with a beautiful Hamilton watch as a token of friendship and appreciation.

Frederick B. Heitkamp, Now a Member of Executive Staff of Lyon Metal Products, Inc.

JOHN W. O'LEARY has been re-elected president of the Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill. The other officers re-elected were: Vice-president, H. C. BEAVER, Worthington Pump & Machinery Corporation, Harrison, N. J.; secretary, PAUL C. DEWOLF, Brown & Sharpe Mfg. Co., Providence, R. I., and treasurer, ROBERT H. MORSE, Fairbanks, Morse & Co.

GEORGE M. BERNSTEIN & Co., dealer in new and used machine tools, has recently moved to 12-14 S. Clinton St., Chicago, Ill.

New England

NORTON Co., Worcester, Mass., informs us that the machine tool show held in the company's plant last December has been transferred to England and is now on exhibition at Coventry in the plant of Alfred Herbert, Ltd., which concern has for many years represented the Norton Co. in several foreign markets. The exposition opened in Coventry June 18.

R. L. RICKWOOD has been appointed works manager of the Reed-Prentice Corporation, Worcester, Mass. Mr. Rickwood was formerly connected with the Worthington Pump & Machinery Corporation, of Harrison, N. J., and the Cincinnati-Bickford Tool Co. of Cincinnati, Ohio.

R. V. OLSON, who for several years has been secretary and sales manager of the Mossberg Pressed Steel Corporation, Attleboro, Mass., was elected vice-president and sales manager of the concern at a recent meeting of the board of directors.

GEOMETRIC TOOL Co., New Haven, Conn., announces the appointment of the following agents for the sale of Geometric threading tools, threading machines, and similar products: DUCOMMUN CORPORATION, 219 Central Ave., Los Angeles, Calif., representative for southern California; STAR MACHINERY Co., 1731-1741 First Ave., S., Seattle, Wash., representative for the states of Washington and Oregon.

WILLIAM H. BASSETT, metallurgical manager of the American Brass Co., Waterbury, Conn., has been elected president of the American Society for Testing Materials for 1934-1935.

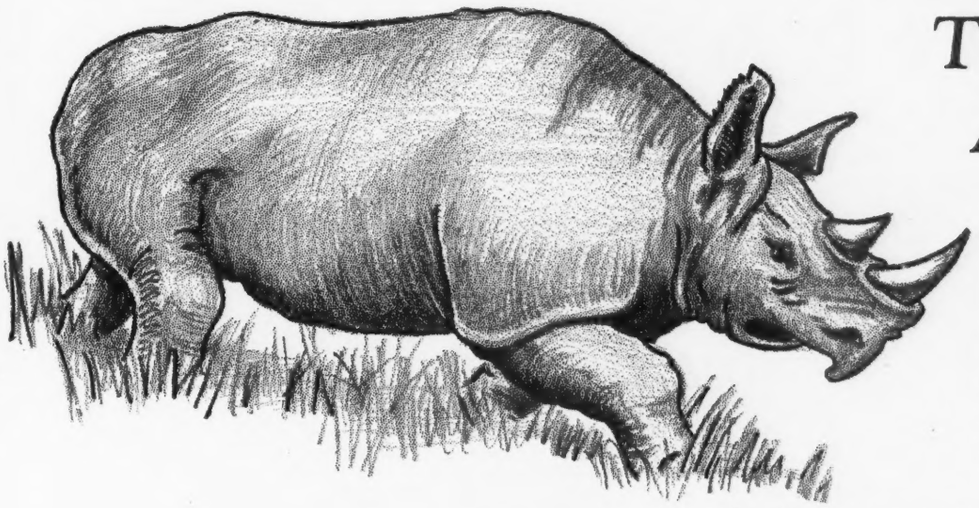
New York and New Jersey

GENERAL ELECTRIC Co., Schenectady, N. Y., announces the election of R. C. MUIR as vice-president in charge of the engineering department; C. E. TULLAR, vice-president in charge of the patent department; and H. L. ANDREWS, vice-president in charge of the activities connected with the electrification of steam railroads.

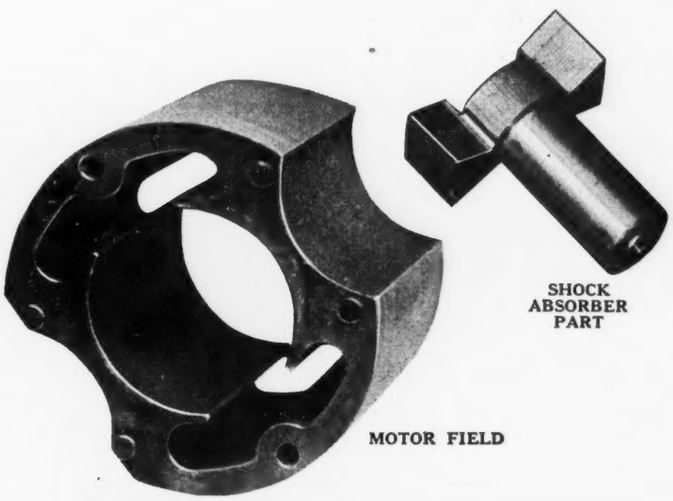
EDWIN W. CLARK, who for the last twenty-five years has been in charge of the New York branch of E. C. Atkins & Co., Indianapolis, Ind., manufacturers of saws and tools, has been promoted from the position of local manager to that of assistant to the general sales manager, N. A. Gladding, at Indianapolis. Mr. Clark will continue to make his headquarters in New York City, at 51 Warren St. EDWARD S. NORVELL, who succeeds Mr. Clark as local manager of the New York branch, was, previous to the war, assistant to Mr. Clark at the New York branch. Subsequent to the war, he was sent to the Indianapolis

POWER AND SPEED

That Carry All Before Them



Records go down, new marks are set, wherever the Carbo Lathe equipped with modern high speed cutting tools is put to work on a really tough lathe job.



SHOCK ABSORBER PART

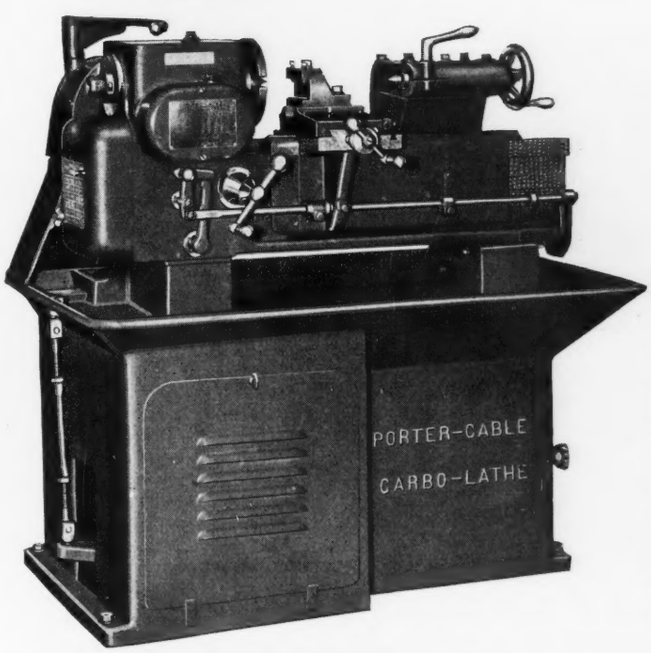
MOTOR FIELD

Speeds high enough to utilize the new tools' maximum efficiency, power to back up the most difficult production program, enable this machine to get highly profitable results on a wide range of single and multiple tool work.

For instance on these typical examples of Carbo-Lathe work — the spindle speed used in boring and facing the Houdaille Shock Absorber part is 334 R.P.M., surface F.P.M.—110, feed —.005″, production is easily maintained at 80 per 55 minute hour.

The other part is a motor field—a single tool job — and both parts are typical Carbo-Lathe work.

Send for production details—time, costs, etc., on work like yours. Our conservative estimates will interest and surprise you.



CARBO-LATHES

Spindle speeds to 2,000 R.P.M.; smooth worm gear drive; 18 Timken and anti-friction bearings; capacity for work within 12″ by 18″. Send samples for guaranteed Carbo-Lathe production data. No obligation.

CARBO-LATHE

PORTER-CABLE MACHINE CO., Syracuse, N.Y.

Machine Tool Builders for 26 Years

REPRESENTATIVES

Colcord-Wright Mchy. & Supply Co., St. Louis, Mo.
Dean Machinery Co., Chicago, Ill.
K. O. Ditmars, Philadelphia, Pa.
Harron, Rickard & McCone Co., San Francisco, Calif.
Herberts Mchy. Co., Ltd., Los Angeles, Calif.
Lynd-Farquhar Co., Boston, Mass.
Joseph Monahan, Grand Rapids, Mich.
Northern Mchy. & Supply Co., Minneapolis, Minn.
Joseph F. Pfaum, Cincinnati, Ohio
Strong, Carlisle & Hammond, Detroit, Mich.
Strong, Carlisle & Hammond, Cleveland, Ohio
C. B. Niver, Toledo, Ohio
Vandyck-Churchill Co., New York City—New Haven, Ct.
Canadian Fairbanks-Morse Co., Ltd. Toronto, Ont.
Williams & Wilson, Ltd., Montreal, Canada

Foreign Representatives

Fenwick Freres & Co., Paris, France
R. S. Stokvis & Zonen, Rotterdam, Holland
Bohm & Bormann, Berlin, Germany
Swiss Mchy. Import Co., Ltd., Zurich, Switzerland
E. P. Bevan & Son, Pty., Ltd., Melbourne, Australia
Machine Tools-India, Ltd., Calcutta, India
Ing. A. Brichts, Prague, Czechoslovakia
Massing & Ingham, Pty., Ltd., Johannesburg, So Africa

Edwin W. Clark, Assistant to General Sales Manager of E. C. Atkins & Co.

office, where he specialized in the metal-cutting and industrial departments, and was later made sales manager of that division. RAY ELLIS, who has been connected with the sales department at the home office as chief clerk for several years, will succeed Mr. Norvell at Indianapolis.

E. D. BRANSOME, of Rumson, N. J., has purchased all the electrode coating patents and methods therefor from the Electric Arc Cutting & Welding Co., 152 Jelliff Ave., Newark, N. J., and from C. J. Holslag of the same address. It is reported that licenses will shortly be granted to the following companies: J. D. Adams Mfg. Co., American Chain Co., American Steel & Wire Co., Bethlehem Steel Co., Indiana Steel & Wire Co., Keystone Steel & Wire Co., Lincoln Electric Co., Pittsburgh Steel Co., Una Welding, Inc., and Wilson Welder & Metals Co., Inc.

EDWARD C. GAINSBORG has been appointed general manager of the Roller Bearing Co. of America, Trenton, N. J. Mr. Gainsborg was formerly sales manager.

Ohio

AJAX MFG. CO., Euclid, Ohio, announces that a report has been filed in a patent infringement suit pertaining to U. S. Patents Nos. 1,297,101 and 1,683,956, by the Special Master to which it was referred by the United States District Court in Cleveland. The report holds that the extension header slide and die slide of the new line of air-clutch forging machines brought out by the Ajax Mfg. Co. do not infringe the patents mentioned.

BUNTING BRASS & BRONZE CO., Toledo, Ohio, has appointed J. R. BATEMAN sales and engineering representative, with headquarters at the Chicago branch of the company. J. F. ROBERTS has been made manager of the Dallas, Tex., branch, R. H. ROBERTS manager of the Kansas City branch, and F. W. ROBERTS manager of the Metropolitan New York branch.

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, has appointed RAILEY & MILAN, INC., 27-39 W. Flagler St., Miami, Fla., distributor of Enduro stainless steel and Toncan iron. The OHIO VALLEY HARDWARE & ROOFING CO., Evansville, Ind., has also been appointed a distributor of Toncan iron.

CHARLES W. DEAN, who for the last five years has been associated with the Cleveland office of the Crocker-Wheeler Electric Mfg. Co., Ampere, N. J., has been made Cleveland district manager to fill the vacancy left by the death of Fred C. Eckworth. Mr. Dean is a graduate electrical engineer of Cornell University.

L. S. HAMAKER, sales promotion manager of the Republic Steel Corporation, Youngstown, Ohio, has been advanced to the position of vice-president and general manager of the Berger Mfg. Co., Canton, Ohio, a subsidiary of the Republic Steel Corporation.

LEE B. GREEN, formerly works manager of the Globe Machine & Stamping Co., 1200-1250 W. 76th St., Cleveland, Ohio, was appointed a director and vice-president in charge of operations at the last annual meeting of the stockholders. Mr. Green's experience in the field of industrial engineering began with his apprenticeship at the Morgan Engineering Co., Alliance, Ohio. Later he became a designer on the engineering staff of the Cleveland Frog & Crossing Co. His other experience included positions as chief engineer of the Stereotype Co., Indianapolis, Ind.; general master mechanic of the Timken Roller Bearing Co., Canton, Ohio; and superintendent of the Lincoln Motor Co., Detroit, Mich.

Lee B. Green, Director and Vice-president of the Globe Machine & Stamping Co.

Edward S. Norvell, Manager of the New York Branch of E. C. Atkins & Co.

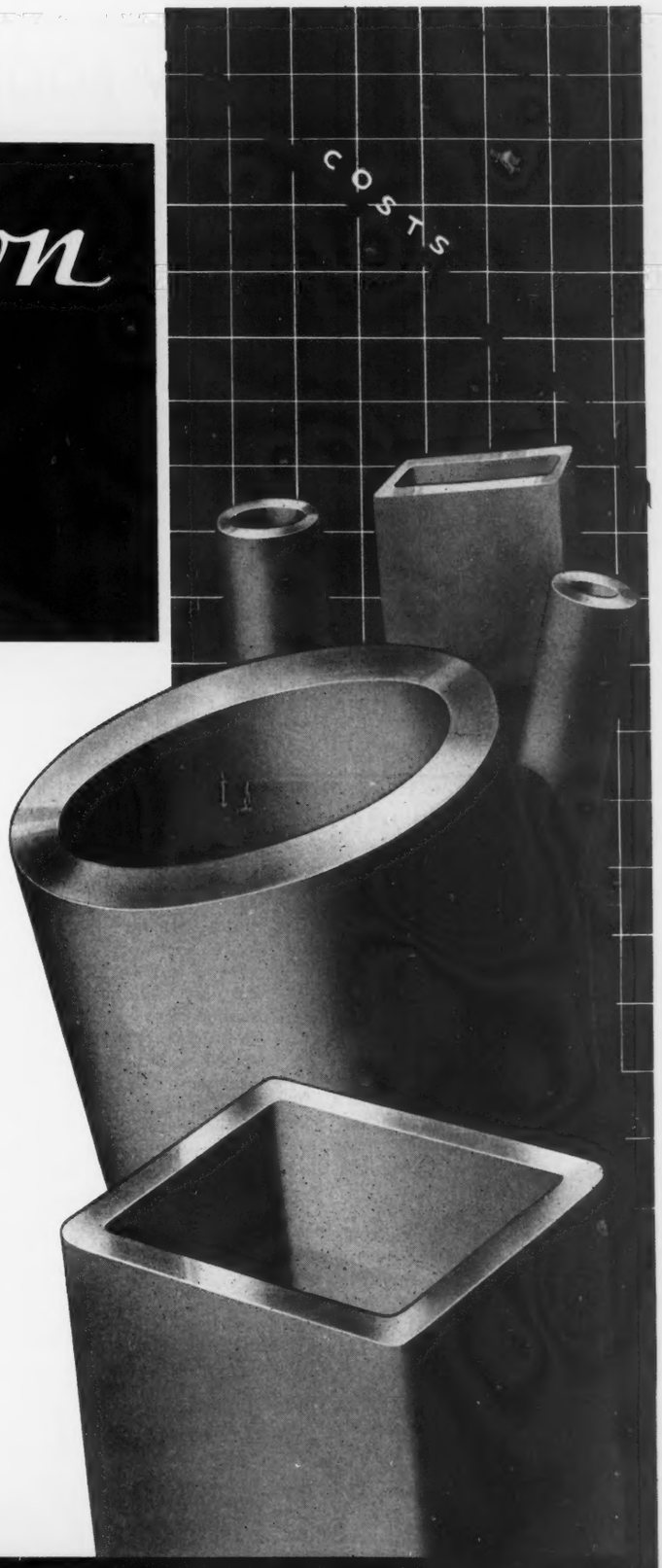
DR. BRUCE W. GONSER has been appointed a member of the technical staff of Battelle Memorial Institute, Columbus, Ohio.

Pennsylvania

E. S. MCCLELLAND, director of personnel of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has retired after fifty-three years of continuous service with the company. Mr. McClelland started with the company in 1881, at the age of seventeen, as a helper in the foundry of the Westinghouse Machine Co., the forerunner of the Westinghouse Electric & Mfg. Co., which was incorporated in 1886. After working in the pattern shop, drafting, and engineering departments, he became successively assistant chief engineer, assistant general superintendent, and works manager. In 1920 he became director of personnel.

R. L. TEMPLIN, chief engineer of tests, Aluminum Co. of America, Pittsburgh, Pa., has been awarded the Charles B. Dudley medal for 1934 by the American Society for Testing Materials. The medal is awarded annually to the author of the paper presented at the preceding annual meeting, which is of most outstanding merit and which constitutes an original contribution to research in engineering materials. Mr. Templin's paper was entitled "The Fatigue Properties of Light Metals and Alloys." The medal was awarded at the annual meeting of the American Society for Testing Materials held at Atlantic City, June 25 to 29.

Pull down



When you adopt NATIONAL-SHELBY Seamless Tubing for making any part, the "COST" line on your graph sheet goes down. This is being turned to account by an increasing number of manufacturers who use one or another of the various shapes, sizes, and wall-thicknesses of NATIONAL-SHELBY Tubing as a short-cut in fabrication. They find that machining operations are minimized, labor economized, and wear on tools very much reduced. As for the practical result—they know the finished part will be of fine, uniform steel structure throughout.

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SEAMLESS MECHANICAL TUBING

Southern States

LOUIS ALLIS CO., Milwaukee, Wis., manufacturer of industrial type electric motors, has opened a direct factory branch office in the Bona Allen Building, Atlanta, Ga., in order to better serve the southeastern states. George C. Gardner, who has been identified with the electric motor industry in Atlanta and the South for many years, will have charge of the new office.

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill., has recently opened a warehouse at 413-15 Second Ave., Dallas, Tex., where extensive stocks will be carried of Caldwell and Link-Belt conveying and power-transmitting machinery. The new warehouse occupies a floor space of 10,000 square feet. The company's sales office will also be located at the warehouse. E. G. WENDELL is resident manager.

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, has appointed the Pidgeon-Thomas Iron Co., Iowa at S. Main St., Memphis, Tenn., distributor of Enduro stainless steel.

COMING EVENTS

OCTOBER 1-5—NATIONAL METAL CONGRESS AND EXPOSITION, Commerce Hall, Port Authority Bldg., New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, director.

OCTOBER 1-5—Annual convention of the AMERICAN SOCIETY FOR METALS (formerly the American Society for Steel Treating), New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, secretary.

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NOVEMBER 8-24—Exposition of machinery and tools at Olympia, London, England.

DECEMBER 3-7—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York.

DECEMBER 3-8—ELEVENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York City. Manager Charles F. Roth, International Exposition Co., Grand Central Palace.

NEW BOOKS AND PUBLICATIONS

BACON'S PUBLICITY MANUAL. 87 pages, 8 1/2 by 11 inches. Published by R. H. Bacon & Co., 608 S. Dearborn St., Chicago, Ill. Price, $3.

The Bacon's Publicity Manual may briefly be described as a guide giving detailed instructions on how to prepare and place industrial editorial publicity. It deals with the handling of editorial publicity in trade and class papers, and contains a complete directory of 1600 publications, with an analysis of the field of each. Sales managers, advertising managers, publicity managers, advertising agencies, and trade associations' secretaries will find this manual of the greatest value in efficiently cooperating with trade journals.

The book differs most decidedly from the ordinary books on "how to write for the press." It is in no sense a text-book and does not deal with abstract theories, but lays down specific rules for obtaining high-grade publicity and shows how to select the trade journals in which this publicity should be sought.

The manual represents the experience gained by the author during the fifteen years that he was engaged in all phases of publicity work as an editor of trade journals, and as advertising and publicity manager.

The book is divided into three sections covering, first, the planning of editorial publicity, the preparation of manuscripts and illustrations, and a complete review of methods to be followed in editorial publicity; second, an alphabetical index of every trade, technical, industrial, and class paper published in the United States and Canada; and third, a market classification of 1600 publications giving detailed information relating to each.

MACHINE DESIGN. By Louis J. Bradford and Paul B. Eaton. 289 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $3.

This is the third edition of a work covering the fundamental principles of machine design, prepared as a text-book for courses in machine design where time is limited. The text is arranged to cover about twenty-five lesson assignments. Discussions of special types of machines have been omitted, as well as data usually found in handbooks. The authors' aim has been to teach the students to use data rather than merely to offer them a source of data.

The principal change in the present edition is in that portion of the book dealing with lubrication, excellent charts having been added that permit the accurate design, without recourse to difficult mathematics, of bearings to which the hydrodynamic theory applies. In view of the growing importance of welded construction in machine design, a section dealing briefly with this subject has been included. Additional problems have also been provided to increase the usefulness of the text to teachers.

An idea of the scope of the book will be obtained from the following chapter headings: Fundamental Definitions and Considerations; Friction and Lubrication; Bearings and Sliding Surfaces; Friction Clutches and Brakes; Shafts; Force and Shrink Fits; Screws and Screw Fastenings; Toothed Gearing; Wrapping Connectors; Springs; Flywheels; and Miscellaneous Machine Elements.

MACHINE SHOP TECHNOLOGY. A Unit Course of Instruction for Students and Apprentices in the Machinist and Toolmaker Trades. Published by the National Metal Trades Association, People's Gas Building, Chicago, Ill. Price, $8 per set. Individual sections: Hand Tool, 80 cents; Engine Lathe, $3; Milling Machine, $1.40; Cylindrical Grinding Machine, $1.40; Shaper, $1.60; and Turret Lathe, $1.80. Special fiber board post binders are available at 50 cents each.

This unit course of instruction consists of loose-leaf bulletins containing 226 lesson units amounting to more than 1000 pages with over 600 illustrations covering the design, construction, care, and use of the tools and machines used in the machinists' and toolmakers' trades. The six sections of the course now ready are: Hand tools, measuring and recording instruments; the engine lathe; the milling machine; the cylindrical grinding machine; the shaper; and the turret lathe. The course was developed by the Committee on Industrial Education of the National Metal Trades Association assisted by more than one hundred practical shop men and a group of trade school instructors. It is suitable for use in company training programs or in public schools giving instruction in these trades.

A HANDBOOK OF NRA (Second Edition). By Lewis Mayers. 842 pages, 6 by 9 inches. Published by Federal Codes, Inc., 32 Union Square, New York City. Price, $6.50 (with semi-monthly supplements to December 31, 1934, $10).

This book contains an analysis and compilation of the National Industrial Recovery Act and related statutes—federal and state—and of all executive orders, regulations, agreements, administrative rulings, and judicial decisions

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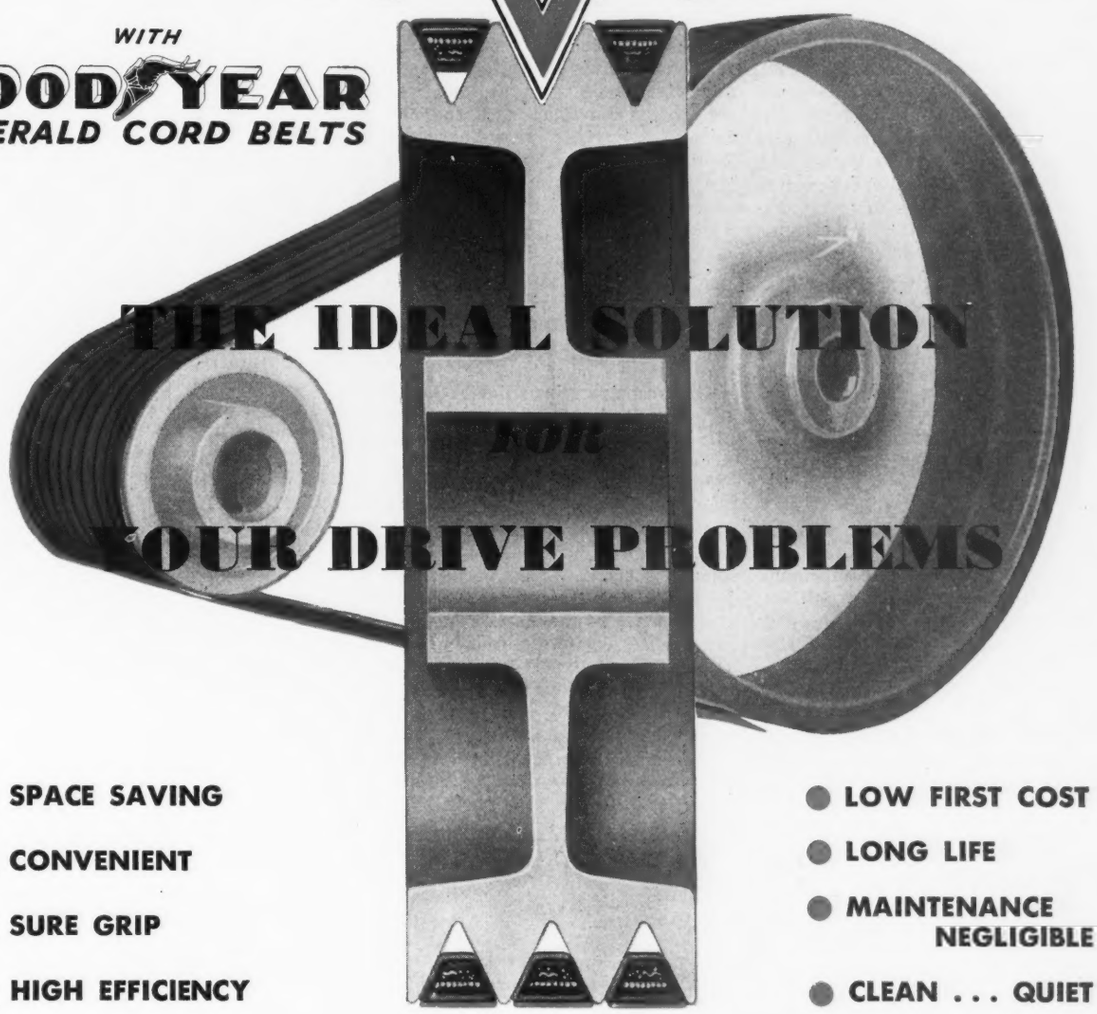

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130 DEALERS THROUGHOUT THE UNITED STATES

relative thereto, together with a comparative presentation of typical provisions of the several codes of fair competition, the texts of the principal codes, and summaries of all minor codes. A semi-monthly supplement service keeps the volume up to date, and proposed codes are furnished at a nominal charge.

HIGH-TEMPERATURE INSULATION. 30 pages, 6 by 9 inches. Distributed by the Johns-Manville Corporation, 22 E. 40th St., New York City.

This booklet contains a reprint of a lecture on high-temperature insulation, prepared by the Johns-Manville engineering department and used in mechanical, chemical, metallurgical, and ceramic engineering schools throughout the country. It comprises a short review of the principles of heat transfer; a discussion of the theory and practice of conductivity values of insulation and refractories; and insulation in boilers, furnaces, and other industrial equipment operated at high temperatures.

* * *

Bausch & Lomb will Welcome Visitors

During the Rochester (New York) Centennial Celebration, which will be held August 20 to 25, the plant of the Bausch & Lomb Optical Co., comprising sixteen buildings with over a million square feet of floor space, will be open to visitors. A schedule of trips under the direction of special guides is being arranged so that visitors may see what has been called "the most critical industrial organization in America," where precision and inspection are carried to lengths measured in millionths of an inch.

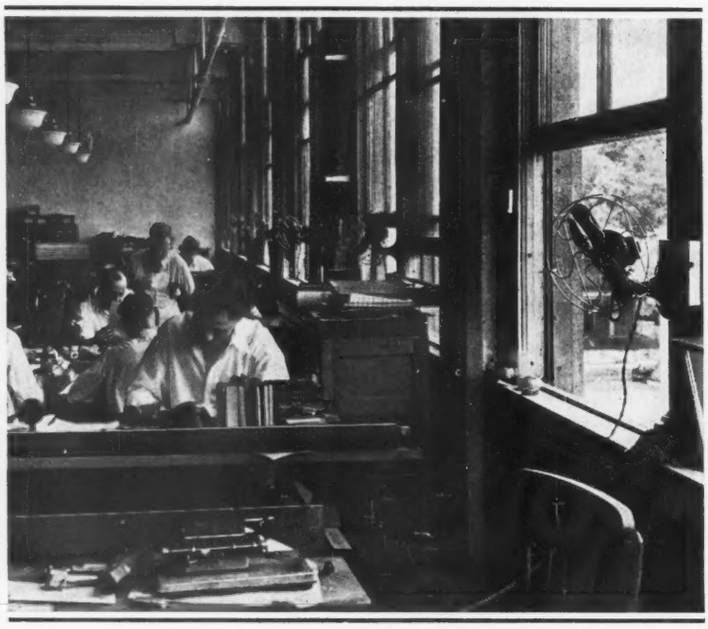
Mechanical Engineers Meet in Denver

The semi-annual meeting of the American Society of Mechanical Engineers was held in Denver, Colo., June 25 to 28. The technical sessions were devoted to subjects of particular interest to the engineers in the Middle West and in the western part of the country. Among the subjects covered were aerial passenger tramways; Boulder Dam developments; humidity and air conditioning in high altitudes; industrial management and the NRA; cooperative manufacturing; and light-weight trains and railroad cars. In connection with the meeting, inspection trips were arranged to Boulder Dam, and trips were made to the Rocky Mountain National Park and over the new Dotsero cut-off through the Moffat tunnel.

* * *

Drafting-Room Ventilation in Hot Weather

The accompanying illustration shows how the Barber-Colman Co., Rockford, Ill., has solved the problem of keeping one of the company's drafting-rooms cool during the hot weather. Small oscillating fans are mounted between the windows and are operated at slow speed. In this way, a gentle but steady breeze is circulated where it is most needed, and the draftsmen work in comparative comfort. The fans are of the Barber-Colman Co.'s own make, manufactured under the trade name "Barcol," but any fan that can be hung between the windows in the manner shown will prove satisfactory. It is stated that the circulation produced by these fans has very noticeably improved the working conditions.



The Barber-Colman Drafting-room Kept Cool on a Hot Day by Means of Well Distributed Fans

OBITUARIES

EDWARD M. HEWLETT, veteran engineer with the General Electric Co., Schenectady, N. Y., who retired from active service in 1931, died at his home in Schenectady May 24, following an illness of a few days, at the age of sixty-eight. Mr. Hewlett began his electrical career with the Thomson-Houston Electric Co. (a predecessor of the General Electric Co.) in 1890. In 1898, when the General Electric Co. organized its switchgear department, Mr. Hewlett was made head of that department and continued there until 1927, when he was appointed consulting engineer. From 1894 on, Mr. Hewlett was responsible for much notable work in switchboard design.

FRED C. ECKWORTH, Cleveland manager of the Crocker-Wheeler Electric Mfg. Co., Ampere, N. J., passed away at the University Hospital, Cleveland, Ohio, on June 1. Mr. Eckworth was forty-nine years of age. He had been a member of the Crocker-Wheeler sales force for eighteen years, nine of which he was Cleveland manager for the company. He leaves a host of friends throughout the Cleveland district, especially in the iron and steel industries.

* * *

Rubber Now Used in Putty

Plastikon putty, a compound that is similar in appearance and consistency to ordinary painter's putty but that is combined with rubber, is a new product of the B. F. Goodrich Rubber Co., Akron, Ohio. This putty requires no mixing, since it contains practically no oil. It effectively resists corrosive chemicals and fumes, and because of its rubber content, offers unusually high resistance to moisture.

Another property that is peculiar to Plastikon putty is its high degree of adherence to steel surfaces. It is available in 1-pint, 15-pound, 75-pound, and 225-pound cans.

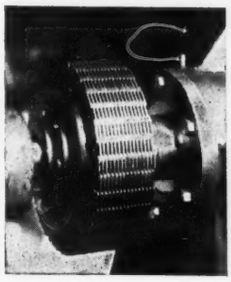
* * *

Automotive Engineers Meet

The summer meeting of the Society of Automotive Engineers, held at Saranac Lake, N. Y., June 17 to 22, was unusually well attended and was characterized by intensely interesting technical sessions, covering every branch of automotive engineering. Among the subjects discussed were Diesel-engine design; rail cars; streamlining; truck design; body design; fuels and lubricants; bearings; aircraft engines; and propellers. In all, about thirty different papers were presented, most of which were based on exhaustive research and painstaking investigations.

POWER TRANSMISSION NEWS

More Than One Way to Join Two Shafts



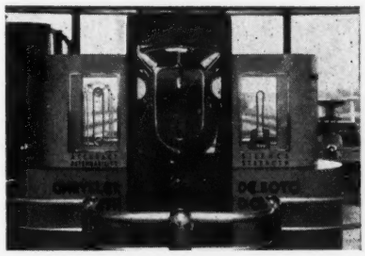
Modern power transmission frequently requires not only the positive coupling of shafting but more or less flexibility to compensate for any slight misalignment that may be present.

One ingenious solution of this problem is accomplished by a unique assembly developed by the Morse Chain Company, of Ithaca, N. Y., and is as simple as it is efficient.

The assembly consists of two sprockets fastened securely to the ends of the shafting, wrapped by a Morse Silent Chain, entirely enclosed in split covers and packed in grease.

The flexible chain transmits the load between the sprocket halves and, due to the great number of contact points between the links in the chain and the sprocket teeth, the load is so distributed that stress at any one point is small. The action of the chain connection between the sprockets cushions shock, dampens vibration and provides the necessary flexibility. Easily attached or disconnected, either half can be moved without disturbing the other half.

Morse Exhibit at Century of Progress



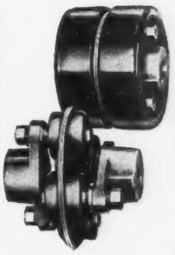
Morse Chain Company have a unique action exhibit in the Chrysler Building. A Translux picture is used, showing the front end of a Plymouth car with timing chain in action. This, with two striking demonstrations of smooth action, shows the accuracy and efficiency of Morse Chains.

Misalignment in Shafting

Where the angular distortion is not high enough to require universal joints, a new flexible coupling has been developed by the Morse Chain Company that takes care of misalignment up to 6°.

This is known as the Morflex Coupling. It depends upon rubber as the flexing medium and compensates for both angular and parallel misalignment without a measurable loss of power.

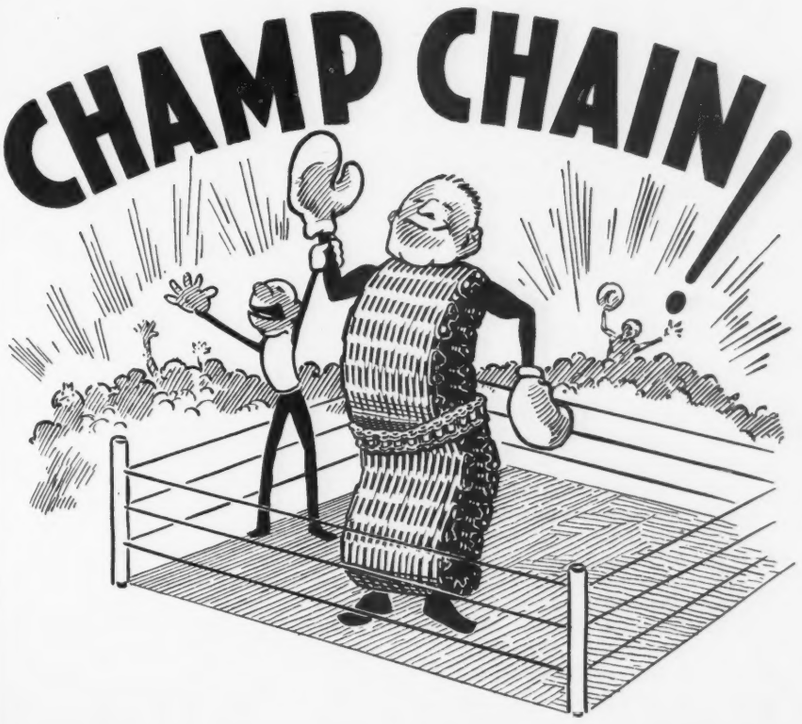
Recent developments and knowledge of the physical properties of rubber have brought it into extensive use in engineering fields. Properly used, it is superior to other materials in providing the qualities required in a flexible coupling.



Driving Tanning Drums

We have come a long way since we tanned a hide by "nailing it on the fence." The leather industry is becoming more and more mechanized and they find increasing use for positive power transmission.

The Deford Company, leather manufacturers of Luray, Va., installed Morse drives about a year ago on their Kannel Process tanning drums. They report, "These drives are working perfectly."



POWERFUL · FLEXIBLE · SMOOTH

. . . and how he can take it!

Chain drives knock 'em all out when you consider their long life and low maintenance costs. They parry every blow, never take the count. No matter how hard the punishment, chain drives always stay in the ring. They have been taking it for many years and getting better all the time.

MORSE CHAIN COMPANY

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Your Progress Depends Upon Your Knowledge of Your Industry

1,683,956 covering the extension heading and gripping slides used in the National high-duty forging machine, that no decree has yet been entered in the suit. The National Machinery Co. has taken exception to the recommendations filed by the Special Master in the suit, and these exceptions will come before the U. S. District Court for decision on the questions of validity and infringement.

CITY MACHINE & TOOL WORKS, Dayton, Ohio, manufacturers of gear chamfering and burnishing machines, precision boring machines and spindles, special machinery, tools, dies, and jigs, have been reincorporated under the name THE CIMATOOL CO. There has been no change either in company policy or executive personnel, except for the addition of shop executives recognized as specialists in large body die practice.

K. B. BOWMAN has been appointed general superintendent of the steel mill of the Timken Steel & Tube Co., Canton, Ohio. Mr. Bowman has previously been associated with the Central Steel Co., Central Alloy Steel Co., and the Republic Steel Corporation. Previous to his present promotion, he was director of production with the Timken Steel & Tube Co.

STANLEY A. KNISELY has been appointed advertising and sales promotion manager of the Republic Steel Corporation, Youngstown, Ohio. Mr. Knisely succeeds L. S. HAMAKER, who was recently made vice-president and general manager of the Berger Mfg. Co., Canton, Ohio, a subsidiary of the Republic Steel Corporation.

H. O. SWOBODA, INC., 4301 Main St., Pittsburgh, Pa., has appointed C. W. PIPER, 2033 Maple Ave., Norwood, Ohio, sales representative for the Falcon line of heat-treating furnaces and industrial heating equipment in the southern Ohio and eastern Indiana territory.

Pennsylvania

A. D. HUNT has been made manager of engineering at the South Philadelphia plant of the Westinghouse Electric & Mfg. Co., succeeding JOHN M. LESSELLS, who has resigned to open an office as consulting engineer, specializing in mechanical work.

CASSIUS M. DAVIS, assistant engineer of the General Electric Co.'s transportation department at Erie, Pa., has been appointed engineer of the department, succeeding H. L. ANDREWS, who was recently elected a vice-president of the company.

LOUIS ALLIS CO., Milwaukee, Wis., manufacturer of electric motors and similar equipment, announces that the Pittsburgh office of the company has been moved to 537 Oliver Bldg., with J. F. Rodgers in charge.

NEW BOOKS AND PUBLICATIONS

THE ENGINEERS' SKETCH BOOK. 355 pages, 5 1/2 by 8 1/2 inches. Published by E. & F. N. Spon, Ltd., London, England. American agent, Engineers Book Shop, 227 Park Ave., New York. Price, $4.50.

This is the sixth edition of a work consisting of a large variety of mechanical movements, mechanisms, and machine elements employed for practically every conceivable purpose. There are nearly 3000 illustrations of mechanisms and machine details, all classified and arranged to facilitate reference. Every right-hand page is filled with numbered drawings or illustrations of mechanisms and unit parts, and the left-hand pages contain terse descriptions which are numbered in each case to agree with the illustration number. This book evidently is intended for the designer, inventor, or mechanic requiring a large collection of mechanical movements and designs from which helpful suggestions or hints can be derived.

LOGARITHMS—NUMERICAL AND GRAPHICAL. By N. R. Corke. 79 pages, 8 1/2 by 11 inches. Published by Gee & Co., Ltd., 6 Kirby St., London, E. C. 1, England. Price, 8/6 net.

This book, as stated in the foreword, is not intended to teach mathematics, but is designed merely to teach the art of calculating by logarithms, both numerically and graphically. It is believed that this book brings together for the first time the four chief practical applications of logarithms — calculating with logarithms; calculating with the slide-rule; plotting and calculating on logarithmic paper; and calculating with alignment charts (nomograms). It is designed for self study. This book should be very useful to the student who wishes to obtain an all-around conception of logarithms.

REPEATED-STRESS (FATIGUE) TESTING MACHINES USED IN THE MATERIALS TESTING LABORATORY OF THE UNIVERSITY OF ILLINOIS. By Herbert F. Moore and Glen N. Krouse. 36 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Circular No. 23 of the Engineering Experiment Station. Price, 40 cents.

THERMAL CONDUCTIVITY OF SOME IRONS AND STEELS OVER THE TEMPERATURE RANGE 100 TO 500 DEGREES C. By S. M. Shelton. 10 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper RP669 of the Bureau of Standards. Price, 5 cents.

TAPER ROLLER BEARINGS (Second Edition). 9 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Simplified Practice Recommendation R67-33 of the Bureau of Standards. Price, 5 cents.

ECONOMIC LOT SIZES IN MANUFACTURING. By Paul T. Norton, Jr. 31 pages, 6 by 9 inches. Published by the Virginia Polytechnic Institute, Blacksburg, Va., as Bulletin No. 31 of the Engineering Extension Division Series.

COMING EVENTS

SEPTEMBER 20-22—Convention of the NATIONAL INDUSTRIAL ADVERTISERS' ASSOCIATION, at Cincinnati, Ohio. For further information, address Gregory H. Starbuck, General Electric Co., Schenectady, N. Y.

OCTOBER 1-5—NATIONAL METAL CONGRESS AND EXPOSITION, Commerce Hall, Port Authority Bldg., New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, director.

OCTOBER 1-5—Annual convention of the AMERICAN SOCIETY FOR METALS (formerly the American Society for Steel Treating), New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, secretary.

OCTOBER 22-26—Annual meeting of the AMERICAN FOUNDRYMEN'S ASSOCIATION and Fifth International Foundry Congress and Exposition in the New Auditorium, Philadelphia, Pa. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

NOVEMBER 8-24—Exposition of machinery and tools at Olympia, London, England.

DECEMBER 3-7—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York.

DECEMBER 3-8 — ELEVENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York City. Manager Charles F. Roth, International Exposition Co., Grand Central Palace.

OBITUARIES

Henry E. Eberhardt

Henry E. Eberhardt, president of the Newark Gear Cutting Machine Co., Inc., Newark, N. J., and an outstanding machine tool building pioneer, died June 30 in his eighty-third year.

Mr. Eberhardt was born in Newark and attended the Newark public schools,

Henry E. Eberhardt

graduating at the age of thirteen. At the age of fourteen he entered the employ of Ezra Gould, who had a machine shop in Newark. Mr. Eberhardt first worked in Mr. Gould's New York office, but he soon asked to be transferred to the factory in Newark, and there began the kind of work to which he devoted his entire life. He made rapid strides in the shop, and was made a foreman while still serving his apprenticeship.

After completing his apprenticeship, he became for some years a true journeyman, working in Philadelphia, Pittsburgh, and Cleveland, and making lasting friendships wherever he went. Later, he returned to Ezra Gould, and with his elder brother Ulrich, was taken into the partnership known as E. Gould & Eberhardt. While a member of that firm, he invented an automatic gear-cutting machine, a printing press for printing bank notes for the Government, and many other mechanical devices, such as the arrangement of gearing which made feeds and speeds of machine tools independent of each other. The latter device was used on lathes, drilling machines, and automatic gear-cutting machines.

In 1904, he sold his interest in the firm of Gould & Eberhardt and entered into business with his sons, the firm at first being known as Eberhardt Brothers, but later becoming the Newark Gear Cutting Machine Co., of which he remained president until his death.

Mr. Eberhardt was one of those mechanical geniuses that truly loved his work; yet, while his vocation was always first in his mind, he had plenty of room for avocations. His collection of rare old books, some on parchment, dealing with engineering subjects is unique. He was one of the first to use high-powered "magic lanterns" and color-photography cameras. He began to drive an automobile in 1901, a Columbia Electric. He always kept abreast, if not a little ahead, of the times. He was a pioneer in his vocation as well as in his avocations. He was also a talented musician, and in his younger years, a singer.

Mr. Eberhardt was beloved by everyone who came in contact with him. He was one of the founders of the American Gear Manufacturers' Association and held high office in that Association for many years. It is safe to say that he was one of the best beloved of all the officers and members in the gear-manufacturing field.

Mr. Eberhardt is survived by four sons, Henry J., Frank E., U. Seth, and Fred Ross Eberhardt. The three older sons are connected with the Newark Gear Cutting Machine Co., while Fred Ross, the youngest, is engaged in a machinery business of his own in Denver, Colo. Mr. Eberhardt is also survived by his daughter, Mrs. Edward Van Egri, twelve grandchildren, and two great grandchildren.

Llewellyn W. Jones

Llewellyn W. Jones, founder and president of the Manganese Steel Forge Co., Philadelphia, Pa., and president of the Audubon Wire Cloth Corporation, also of Philadelphia, died at his home in Rosemont, Pa., on June 24, in his seventy-second year.

Mr. Jones was born in Philadelphia. He served an apprenticeship with William B. Bement & Sons, and later entered a three-year course of instruction in locomotive and car building at the Altoona Shops of the Pennsylvania Railroad. He successively held important executive positions with the Philadelphia Drop Forge Co., Schoen Pressed Steel Co., Pressed Steel Car Co., M. B. Suydam Paint Co., Pittsburgh Filter Co., Cyclops Foundry Co., Taylor-Wharton Iron & Steel Co., and Alloy Steel Forging Co.

In 1921, Mr. Jones founded the Manganese Steel Forge Co. Credit is due him for the mechanical and commercial developments of rolled and forged manganese steel that made it available to a wide range of industries. He produced the first drawn manganese steel wire, now widely used in wire cloth and in the electric industry. He also introduced rolled and forged manganese steel as wear plates and forgings in the street and steam railway industry.

E. K. Swigart

Edmund Kearsley Swigart, chairman of the board of the Oilgear Co., Milwaukee, and senior vice-president of the Bucyrus-Erie Co., South Milwaukee, Wis., died suddenly at Ballard Lake, Wis., following a heart attack.

Mr. Swigart was born in Bucyrus, Ohio, in 1867. He graduated from the Toledo High School and entered the Railroad Mail Service in which he remained for ten years. In 1891 he joined the Bucyrus-Erie Co. and was made secretary and treasurer of that company in 1901. As secretary he was also responsible for sales. In 1910, he became a joint managing director of the company, and in 1911, he was made senior vice-president, a position which he held until his death. In 1921, he founded the Oilgear Co.

Mr. Swigart was also a member of the executive committee and board of directors of the Bucyrus-Erie Co. and a member of the board of directors of the Bucyrus-Monighan Co., of Chicago, Ill.

Few men leave behind them a record of achievement such as his. He was held in high regard by all who knew

E. K. Swigart

him, and his success as a business man and a friend was due to his strong character, pleasing personality, unusual ability to judge men, and sound judgment.

JOHN E. BARKLE, general manager of the South Philadelphia Works of the Westinghouse Electric & Mfg. Co., died suddenly at his home in Swarthmore, Pa., July 10, at the age of fifty-three years. Mr. Barkle was born in Orbisonia, Pa. He was a graduate of Dickinson College, and has been continuously in the service of the Westinghouse company for thirty-three years. He was appointed works manager of the South Philadelphia Works in 1929, and general works manager in 1931.

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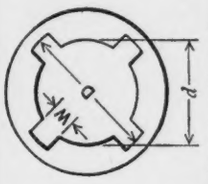
DIMENSIONS FOR FOUR-SPLINE SHAFT FITTINGS*
S. A. E. Standard



For permanent fit { $W = 0.241D$, $d = 0.850D$

For slide fit when under no load.... { $W = 0.241D$, $d = 0.750D$

Nominal Diameter	Permanent Fit D Max.	Permanent Fit D Min.	Permanent Fit d Max.	Permanent Fit d Min.	Permanent Fit W Max.	Permanent Fit W Min.	Permanent Fit T†	Slide Fit When Under No Load d Max.	Slide Fit When Under No Load d Min.	Slide Fit When Under No Load T†	Slide Fit When Under No Load W Max.	Slide Fit When Under No Load W Min.	Slide Fit When Under No Load T†
3/4	0.750	0.749	0.637	0.636	0.181	0.179	78	0.638	0.637	117	0.181	0.179	123
7/8	0.875	0.874	0.744	0.743	0.211	0.209	107	0.744	0.743	159	0.211	0.209	167
1	1.000	0.999	0.850	0.849	0.241	0.239	139	0.850	0.849	208	0.241	0.239	219
1 1/8	1.125	1.124	0.956	0.955	0.271	0.269	175	0.956	0.955	263	0.271	0.269	277
1 1/4	1.250	1.249	1.062	1.061	0.301	0.299	217	1.063	1.062	325	0.301	0.299	341
1 3/8	1.375	1.374	1.169	1.168	0.331	0.329	262	1.169	1.168	393	0.331	0.329	414
1 1/2	1.500	1.499	1.275	1.274	0.361	0.359	311	1.275	1.274	468	0.361	0.359	491
1 5/8	1.625	1.624	1.381	1.380	0.391	0.389	367	1.381	1.380	550	0.391	0.389	577
1 3/4	1.750	1.749	1.487	1.486	0.422	0.420	424	1.488	1.487	637	0.422	0.420	670
2	2.000	1.998	1.700	1.698	0.482	0.479	555	1.700	1.698	833	0.482	0.479	875
2 1/4	2.250	2.248	1.912	1.910	0.542	0.539	703	1.913	1.911	1052	0.542	0.539	1106
2 1/2	2.500	2.498	2.125	2.123	0.602	0.599	865	2.125	2.123	1300	0.602	0.599	1365
3	3.000	2.998	2.550	2.548	0.723	0.720	1249	2.550	2.548	1873	0.723	0.720	1969

*All dimensions in inches. Dimensions are intended to apply to the soft broached hole only. Allowance must be made for machining the shaft to give the required fit. No allowance is made for radii on corners of splines or for clearances. Radii on corners, however, should not exceed 0.015 inch. Splines shall not be more than 0.006 inch per foot out of parallel with respect to the axis of the shaft.

†T = pound-inches torque capacity per inch of bearing length at 1000 pounds per square inch pressure on sides of splines.

MACHINERY'S Data Sheet No. 257, New Series, September, 1933

DIMENSIONS FOR SIX-SPLINE SHAFT FITTINGS*
S. A. E. Standard

For permanent fit: $W = 0.250D$, $d = 0.900D$

For slide fit when under no load: $W = 0.250D$, $d = 0.850D$

For slide fit when under load: $W = 0.250D$, $d = 0.800D$

Nominal Diameter	Permanent Fit D Max.	Permanent Fit D Min.	Permanent Fit d Max.	Permanent Fit d Min.	Permanent Fit W Max.	Permanent Fit W Min.	Permanent Fit T†	Slide Fit When Under No Load‡ d Max.	Slide Fit When Under No Load‡ d Min.	Slide Fit When Under No Load‡ T†	Slide Fit When Under Load‡ d Max.	Slide Fit When Under Load‡ d Min.	Slide Fit When Under Load‡ T†
3/4	0.750	0.749	0.675	0.674	0.188	0.186	80	0.638	0.637	117	0.600	0.599	152
7/8	0.875	0.874	0.788	0.787	0.219	0.217	109	0.744	0.743	159	0.700	0.699	207
1	1.000	0.999	0.900	0.899	0.250	0.248	143	0.850	0.849	208	0.800	0.799	270
1 1/8	1.125	1.124	1.013	1.012	0.281	0.279	180	0.956	0.955	263	0.900	0.899	342
1 1/4	1.250	1.249	1.125	1.124	0.313	0.311	223	1.063	1.062	325	1.000	0.999	421
1 3/8	1.375	1.374	1.238	1.237	0.344	0.342	269	1.169	1.168	393	1.100	1.099	510
1 1/2	1.500	1.499	1.350	1.349	0.375	0.373	321	1.275	1.274	468	1.200	1.199	608
1 5/8	1.625	1.624	1.463	1.462	0.406	0.404	376	1.381	1.380	550	1.300	1.299	713
1 3/4	1.750	1.749	1.575	1.574	0.438	0.436	436	1.488	1.487	637	1.400	1.399	827
2	2.000	1.998	1.800	1.798	0.500	0.497	570	1.700	1.698	833	1.600	1.598	1080
2 1/4	2.250	2.248	2.025	2.023	0.563	0.560	721	1.913	1.911	1052	1.800	1.798	1367
2 1/2	2.500	2.498	2.250	2.248	0.625	0.622	891	2.125	2.123	1300	2.000	1.998	1688
3	3.000	2.998	2.700	2.698	0.750	0.747	1283	2.550	2.548	1873	2.400	2.398	2430

*All dimensions in inches. Dimensions are intended to apply to the soft broached hole only. Allowance must be made for machining the shaft to give the required fit. No allowance is made for radii on corners of splines or for clearances. Radii on corners, however, should not exceed 0.015 inch.

Splines shall not be more than 0.006 inch per foot out of parallel with respect to the axis of the shaft.

†T = pound-inches torque capacity per inch of bearing length at 1000 pounds per square inch pressure on sides of splines.

‡Dimensions D and W are the same as for permanent fit.

MACHINERY'S Data Sheet No. 258, New Series, September, 1933

PHYSICAL PROPERTIES OF MOLDED PLASTIC MATERIALS*—1

Physical Property	Rubber-Base Thermo-Plastic	Cellulose Acetate	Phenolic	Urea	Nitro-Cellulose
Tensile Strength, Lbs. per Sq. In.	4,000-5,000	3,000-4,000	4,500-12,000	4,000-7,000	4,000-10,000
Compressive Strength, Lbs. per Sq. In.	8,500-11,000	4,000-11,000	28,000-32,000	24,000-30,000	.....
Transverse Strength, Lbs. per Sq. In.	7,000-9,000	6,000-7,000	8,000-20,000	9,000-14,000	.....
Impact Strength, Izod, Ft.-Lb.	.....	0.17-0.62	0.11-0.18	0.14-0.17	0.25
Water Absorption, 24 hr. Immersion, %	0.02-0.1	1.4-1.9	0.02-0.05	0.6-1.8	.....
Surface Resistance, Ohms per In. at 90% Relative Humidity	10^{11} to 10^{13}	5×10^{12} to 5×10^{13}	660×10^{9}	.....	.....
Specific Gravity Water = 1	1.06-1.29	1.29-1.56	1.3-2.0	1.48-1.55	1.35-1.60
Dielectric Constant, Radio Frequency	.....	4.3-5.4	4.5-20	5-6	6.8
Volume Ratio of Powder to Molded Part	2.5 to 1	2.5 to 1	2.3 to 1 7.5 to 1	2.7 to 1 3 to 1	2.28
Heat Resistance without Softening or Charring, Deg. F.	160-280	115-300	300-500	150-245	160-195
Machining Qualities	Good	Fair to Good	Fair to Good	Fair	Good
Molding Temperature, Deg. F.	260-300	267-365	300-360	275-300	190-220
Recommended Molding Pressure, Pounds per Sq. In.	1,500	2,000	1,500-5,000	2,000-4,000	2,000-5,000

*Figures given are, in most cases, as furnished by manufacturers. They vary considerably with the grade of material and filler used and in different makes of the same type of material.

MACHINERY'S Data Sheet No. 259, New Series, October, 1933 Contributed by Herbert Chase

PHYSICAL PROPERTIES OF MOLDED PLASTIC MATERIALS*—2

Physical Property	Hard Rubber	Cold Molded Materials		Vinyl	Styrol
		Asphaltic	Refractory		
Tensile Strength, Lbs. per Sq. In.	4,000-8,000	1,200-2,000	.....	6,000-10,000	7,000
Compressive Strength, Lbs. per Sq. In.	2,000-15,000	3,000-12,000	14,000	.....	.....
Transverse Strength, Lbs. per Sq. In.	9,000-15,000	3,500-4,500	5,000	7,500-13,000	14,000
Impact Strength, Izod, Ft.-Lb.	0.15-0.4 (Charpy)	0.14-0.4 (Charpy)	Low	0.10-0.70	.....
Water Absorption, 24 hr. Immersion, %	0.2-0.4	1-3	2-16	0.05-0.70	0
Surface Resistance, Ohms per In. at 90% Relative Humidity	5×10^{6}	.....	.....	.....	Very High
Specific Gravity Water = 1	1.12-2.0	1.8-2.0	2.1	1.2-1.25	1.05
Dielectric Constant, Radio Frequency	3	.....	.....	4-7	2.9
Volume Ratio of Powder to Molded Part	1.05 to 1	.....	.....	1.5-3.5 to 1	.....
Heat Resistance without Softening or Charring, Deg. F.	120-160	450-600	To 1,800	122-158	194
Machining Qualities	Good	.....	.....	Good	Good
Molding Temperature, Deg. F.	320-355	Room	Room	115-150	200-350
Recommended Molding Pressure, Pounds per Sq. In.	To 2,000	8,000	.....	250-2,000	40-100

*Figures given are, in most cases, as furnished by manufacturers. They vary considerably with the grade of material and filler used and in different makes of the same type of material.

MACHINERY'S Data Sheet No. 260, New Series, October, 1933 Contributed by Herbert Chase

MACHINERY'S DATA SHEETS 261 and 262

PERMISSIBLE VARIATION IN SIZES OF COLD-FINISHED BAR STOCK AND SHAFTING*

Based upon American Society for Testing Materials' Standard Specifications 1930

Cross-section of Bar	Nominal Size, Inches	Permissible Variation in Diameter, Distance Across Flats, Width, or Thickness, Inches	
		Plus	Minus
Round and Hexagonal	Up to 0.030, inclusive	0.0	0.002
	Over 0.030 to 1, inclusive	0.0	0.003
	Over 1 to 2 1/2, inclusive	0.0	0.004
	Over 2 1/2	0.0	0.005
Square	Up to 0.030, inclusive	0.0	0.003
	Over 0.030 to 1, inclusive	0.0	0.004
	Over 1 to 2 1/2, inclusive	0.0	0.005
	Over 2 1/2	0.0	0.006
Rectangular	Up to 0.030, inclusive × 1 1/2 or less	0.0	0.003
	Over 0.030 to 1, inclusive × 1 1/2 or less	0.0	0.004
	Over 1 to 2 1/2, inclusive × 1 1/2 or less	0.0	0.005
	Over 2 1/2 to 4, inclusive × 1 1/2 or less	...	.....
	Over 4 to 6, inclusive × 1 1/2 or less	...	.....
	Up to 0.030, inclusive × over 1 1/2	0.0	0.005
	Over 0.030 to 1, inclusive × over 1 1/2	0.0	0.005
	Over 1 to 2 1/2, inclusive × over 1 1/2	0.0	0.006
	Over 2 1/2 to 4, inclusive × over 1 1/2	0.0	0.007
	Over 4 to 6, inclusive × over 1 1/2	0.0	0.010
Round Shafting	Up to 1, inclusive	0.0	0.002
	1 1/16 to 2, inclusive	0.0	0.003
	2 1/16 to 4, inclusive	0.0	0.004
	4 1/16 to 6, inclusive	0.0	0.005

*This table covers commercial cold-finished bar steels of grades considered to be in common use, including cold-finished Bessemer screw stock, cold-finished open-hearth screw stock, cold-finished shafting, and commercial key stock.

The permissible variations given in the table apply to cold-finished steel having a carbon content not exceeding 0.30 per cent. For bars with higher carbon content, the variations should be agreed upon by the purchaser and manufacturer of the steel.

MACHINERY'S Data Sheet No. 261, New Series, November, 1933

PERMISSIBLE VARIATION IN SIZES OF HOT-ROLLED STEEL BAR STOCK*

Based upon American Society for Testing Materials' Standard Specifications 1930

Cross-section of Bar	Nominal Size, Inches	Permissible Variation in Diameter, Distance Across Flats, Width, or Thickness, Inches†	
		Plus	Minus
Round, Square, and Hexagonal	Up to 1/2, inclusive	0.007	0.007
	Over 1/2 to 1, inclusive	0.010	0.010
	Over 1 to 2, inclusive	1/32	1/64
	Over 2 to 3, inclusive	3/64	1/32
	Over 3 to 5, inclusive	3/32	1/32
	Over 5 to 8, inclusive	1/8	1/16
Rectangular	Up to 1, inclusive × 3/16 or less	1/32 and 0.006	1/64 and 0.006
	Over 1 to 2, inclusive × 3/16 or less	3/64 and 0.008	1/32 and 0.008
	Over 2 to 4, inclusive × 3/16 or less	1/16 and 0.010	3/64 and 0.010
	Over 4 to 6, inclusive × 3/16 or less	3/32 and 0.010	1/16 and 0.010
	Up to 1, inclusive × over 3/16 to 1/2, inclusive	1/32 and 0.008	1/64 and 0.008
	Over 1 to 2, inclusive × over 3/16 to 1/2, inclusive	3/64 and 0.012	1/32 and 0.012
	Over 2 to 4, inclusive × over 3/16 to 1/2, inclusive	1/16 and 0.015	3/64 and 0.015
	Over 4 to 6, inclusive × over 3/16 to 1/2, inclusive	3/32 and 0.015	1/16 and 0.015
	Up to 1, inclusive × over 1/2 to 1, inclusive	1/32 and 0.010	1/64 and 0.010
	Over 1 to 2, inclusive × over 1/2 to 1, inclusive	3/64 and 0.015	1/32 and 0.015
	Over 2 to 4, inclusive × over 1/2 to 1, inclusive	1/16 and 0.020	3/64 and 0.020
	Over 4 to 6, inclusive × over 1/2 to 1, inclusive	3/32 and 0.020	1/16 and 0.020
	Up to 1, inclusive × over 1 to 2, inclusive	1/32	1/64
	Over 1 to 2, inclusive × over 1 to 2, inclusive	3/64 and 1/32	1/32 and 1/32
	Over 2 to 4, inclusive × over 1 to 2, inclusive	1/16 and 1/32	3/64 and 1/32
	Over 4 to 6, inclusive × over 1 to 2, inclusive	3/32 and 1/32	1/16 and 1/32

*This table covers hot-rolled carbon-steel bars produced in accordance with good mill practice for general commercial purposes. The steel is made by either the open-hearth or the Bessemer process.

†For rectangular bars, the first value in the plus and minus columns is for the width, and the second value is for the thickness. For example, if the variation for a bar 2 inches wide and 1/2 inch thick is required, the plus variations will be 3/64 inch for the width and 0.012 inch for thickness; the minus variations will be 1/32 inch for the width and 0.012 inch for the thickness.

MACHINERY'S Data Sheet No. 262, New Series, November, 1933

MAXIMUM LOADS FOR HELICAL SPRINGS AND CORRESPONDING DEFLECTIONS PER COIL—1

MACHINERY'S Data Sheet No. 263, New Series, December, 1933

Based on Standards Adopted by American Society for Testing Materials, 1933

Outside Diameter of Spring, Inches	Diameter of Bar, Inches									
	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1	1 1/16
2	3272 (Load, in pounds)				.....	This table applies to hot-coiled heat-treated carbon steel springs. It is based on a maximum fiber stress of 100,000 pounds per square inch and a torsional modulus of elasticity of 10,500,000 pounds per square inch.				
	0.134 (Deflection per coil, inches)									
2 1/4	2805	4140	.....	.....	.....					
	0.183	0.152	.....	.....	.....					
2 1/2	2454	3606	5113	.....	.....					
	0.239	0.200	0.168	.....	.....					
2 3/4	2181	3194	4511	6187	.....					
	0.303	0.254	0.216	0.185	.....					
3	1963	2866	4036	5518	7363					
	0.374	0.316	0.270	0.233	0.202	.....	.....	.....	.....	.....
3 1/4	1785	2600	3652	4980	6627	8641	.....	.....	.....	.....
	0.452	0.384	0.330	0.285	0.249	0.219	.....	.....	.....	.....
3 1/2	1636	2379	3334	4537	6025	7837	10022	.....	.....	.....
	0.538	0.459	0.396	0.344	0.302	0.266	0.235	.....	.....	.....
3 3/4	1510	2192	3065	4166	5522	7171	9150	11503	.....	.....
	0.632	0.540	0.467	0.408	0.359	0.317	0.282	0.252	.....	.....
4	1402	2033	2840	3852	5097	6608	8418	10564	13090	.....
	0.733	0.628	0.545	0.477	0.421	0.374	0.334	0.299	0.269	.....
4 1/4	.....	1895	2644	3581	4733	6127	7795	9767	12083	14777
	.....	0.723	0.629	0.553	0.489	0.435	0.389	0.350	0.316	0.286
4 1/2	.....	1774	2474	3347	4418	5712	7257	9081	11220	13702
	.....	0.824	0.718	0.632	0.561	0.500	0.449	0.405	0.366	0.333
4 3/4	.....	.....	2324	3141	4142	5352	6789	8486	10472	12773
	.....	.....	0.815	0.718	0.638	0.571	0.513	0.464	0.420	0.383
5	.....	.....	2191	2959	3898	5030	6377	7964	9817	11962
	.....	.....	0.916	0.810	0.720	0.646	0.582	0.527	0.479	0.436
5 1/4	.....	.....	.....	2797	3681	4746	6013	7502	9240	11248
	.....	.....	.....	0.906	0.808	0.725	0.654	0.594	0.540	0.494
5 1/2	.....	.....	.....	2651	3488	4493	5688	7091	8726	10614
	.....	.....	.....	1.008	0.900	0.809	0.731	0.664	0.606	0.554
5 3/4	.....	.....	.....	.....	3313	4266	5396	6723	8267	10049
	.....	.....	.....	.....	0.997	0.898	0.812	0.739	0.675	0.618
6	.....	.....	.....	.....	3155	4060	5133	6391	7854	9540
	.....	.....	.....	.....	1.099	0.991	0.898	0.818	0.748	0.686
6 1/4	.....	.....	.....	.....	.....	3874	4894	6090	7480	9080
	.....	.....	.....	.....	.....	1.088	0.987	0.901	0.824	0.758
6 1/2	.....	.....	.....	.....	.....	3703	4676	5816	7140	8660
	.....	.....	.....	.....	.....	1.191	1.081	0.987	0.905	0.833
6 3/4	.....	.....	.....	.....	.....	.....	4478	5566	6829	8282
	.....	.....	.....	.....	.....	.....	1.180	1.078	0.989	0.910
7	.....	.....	.....	.....	.....	.....	4295	5337	6545	7933
	.....	.....	.....	.....	.....	.....	1.283	1.172	1.077	0.993
7 1/4	.....	.....	.....	.....	.....	.....	.....	5125	6283	7612
	.....	.....	.....	.....	.....	.....	.....	1.271	1.168	1.078
7 1/2	.....	.....	.....	.....	.....	.....	.....	4930	6041	7317
	.....	.....	.....	.....	.....	.....	.....	1.374	1.263	1.167
7 3/4	.....	.....	.....	.....	.....	.....	.....	.....	5817	7043
	.....	.....	.....	.....	.....	.....	.....	.....	1.363	1.259
8	.....	.....	.....	.....	.....	.....	.....	.....	5610	6789
	.....	.....	.....	.....	.....	.....	.....	.....	1.466	1.355

MAXIMUM LOADS FOR HELICAL SPRINGS AND CORRESPONDING DEFLECTIONS PER COIL—2

MACHINERY'S Data Sheet No. 264, New Series, December, 1933

Based on Standards Adopted by American Society for Testing Materials, 1933

Outside Diameter of Spring, Inches	Diameter of Bar, Inches									
	1 1/8	1 3/16	1 1/4	1 5/16	1 3/8	1 7/16	1 1/2	1 9/16	1 5/8	1 11/16
4 1/2	16567 (Load, in pounds)				.....	This table applies to hot-coiled heat-treated carbon steel springs. It is based on a maximum fiber stress of 100,000 pounds per square inch and a torsional modulus of elasticity of 10,500,000 pounds per square inch.				
	0.302 (Deflection per coil, inches)									
4 3/4	15424	18460	.....	.....	.....					
	0.349	0.319	.....	.....	.....					
5	14429	17250	20450	.....	.....					
	0.399	0.366	0.336	.....	.....					
5 1/4	13554	16185	19175	22545	.....					
	0.452	0.416	0.383	0.353	.....					
5 1/2	12780	15250	18045	21200	24750					
	0.509	0.468	0.432	0.400	0.370	.....	.....	.....	.....	.....
5 3/4	12089	14415	17040	20005	23335	27045	.....	.....	.....	.....
	0.569	0.524	0.484	0.449	0.416	0.387	.....	.....	.....	.....
6	11469	13665	16145	18940	22070	25565	29450	.....	.....	.....
	0.632	0.583	0.540	0.501	0.465	0.433	0.404	.....	.....	.....
6 1/4	10910	12990	15340	17980	20940	24235	27900	31955	.....	.....
	0.699	0.645	0.598	0.556	0.517	0.482	0.450	0.420	.....	.....
6 1/2	10402	12379	14610	17115	19920	23040	26505	30340	34565	.....
	0.768	0.711	0.659	0.613	0.571	0.533	0.498	0.467	0.437	.....
6 3/4	9940	11823	13945	16325	18995	21955	25245	28875	32880	37275
	0.841	0.779	0.724	0.674	0.628	0.587	0.550	0.515	0.483	0.454
7	9517	11314	13340	15610	18150	20970	24095	27550	31350	35520
	0.918	0.851	0.791	0.737	0.688	0.644	0.603	0.566	0.532	0.500
7 1/4	9129	10847	12780	14950	17375	20065	23050	26340	29955	33920
	0.998	0.926	0.861	0.804	0.751	0.703	0.659	0.619	0.582	0.548
7 1/2	8770	10418	12270	14345	16665	19240	22090	25230	28680	32460
	1.081	1.004	0.935	0.873	0.816	0.765	0.718	0.675	0.635	0.599
7 3/4	8440	10020	11800	13790	16015	18480	21205	24210	27510	31125
	1.167	1.085	1.011	0.945	0.884	0.829	0.779	0.733	0.691	0.651
8	8133	9653	11360	13275	15405	17770	20390	23270	26430	29890
	1.256	1.169	1.090	1.020	0.955	0.896	0.842	0.793	0.748	0.706
8 1/4	7847	9312	10955	12795	14845	17120	19635	22400	25435	28755
	1.350	1.256	1.173	1.097	1.028	0.965	0.908	0.856	0.808	0.763
8 1/2	7581	8993	10575	12350	14325	16515	18935	21590	24510	27700
	1.447	1.347	1.258	1.177	1.104	1.038	0.977	0.921	0.870	0.823
8 3/4	.....	8696	10225	11935	13840	15950	18280	20840	23650	26710
	.....	1.441	1.346	1.260	1.183	1.113	1.048	0.989	0.934	0.884
9	.....	8418	9895	11550	13385	15420	17670	20140	22845	25805
	.....	1.538	1.437	1.347	1.265	1.190	1.122	1.059	1.001	0.948
9 1/4	.....	.....	9585	11185	12960	14930	17100	19485	22100	24950
	.....	.....	1.532	1.436	1.349	1.270	1.198	1.131	1.070	1.014
9 1/2	.....	.....	9295	10840	12565	14465	16565	18870	21395	24150
	.....	.....	1.629	1.528	1.436	1.353	1.276	1.206	1.141	1.082
9 3/4	.....	.....	.....	10520	12190	14030	16065	18295	20740	23405
	.....	.....	.....	1.622	1.526	1.438	1.357	1.283	1.215	1.152
10	.....	.....	.....	10220	11835	13620	15590	17755	20120	22700
	.....	.....	.....	1.720	1.619	1.526	1.441	1.363	1.291	1.225
10 1/2	.....	.....	.....	.....	11185	12870	14725	16760	18985	21410
	.....	.....	.....	.....	1.811	1.709	1.615	1.530	1.450	1.377
11	.....	.....	.....	.....	.....	12200	13950	15870	17975	20260
	.....	.....	.....	.....	.....	1.903	1.800	1.705	1.618	1.537

MACHINERY'S DATA SHEETS 265 and 266

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MACHINERY'S Data Sheet No. 266, New Series, January, 1934

PROPERTIES OF SILCROME CORROSION- AND HEAT-RESISTING STAINLESS STEELS

Type of Silcrome		12		17	RA			H-17		KA-2		25-12	46-M	
Typical Chemical Analyses	Carbon ..	0.12 max.		0.12 max.	0.12			1.00		0.09–0.20		0.20	0.25 max.	
	Chromium	11.5–13		16.5–17.5	16–17			16.5–18.0		18		25	4–6	
	Nickel ...	.....		.....	.....			.....		8		12	.....	
	Silicon ..	.....		.....	1.00			.....		.....		.....	.....	
	Copper ..	.....		.....	1.00			.....		.....		.....	.....	
	Molybdenum ...	.....		.....	.....			.....		.....		.....	0.50	
Average Tensile Properties at Room Temperature		Annealed	Quenched and Drawn at 750 deg. F.	Annealed	Annealed	Quenched at 1750 deg. F. Drawn at 750 deg. F.	Hard Drawn Wire *	Annealed	Quenched at 1800 deg. F. Drawn at 1100 deg. F.	Annealed	Hard Drawn Wire *	Annealed	Annealed	Quenched and Drawn at 1000 deg. F.
Ultimate Strength, lbs. per sq. in.		65000	130000	75000	80000	110000	125000	120000	175000	90000	200000	95000	68000	117000
Yield point, lbs. per sq. in.		35000	95000	43000	40000	65000	110000	60000	140000	30000	150000	48000	29000	101000
Elongation in 2 in., per cent		30	15	28	35	25	10	10	7	55	25	42	32	18
Reduction of Area, per cent		60	35	55	65	55	70	15	10	65	45	50	70	64
Impact Izod, ft.-lbs..		76	35	30	35	15	..	5	3	85	..	..	72	67
Brinell Hardness ...		156	280	170	160	241	260	240	350	150	315	167	142	262
Rockwell Hardness..		B78	C28	B84	B85	B100	C26	C28	C38	B80	C30	B85	B76	C26
Specific Gravity, lbs. per sq. in.		0.28		0.277	0.277			0.277		0.285		0.282	0.28	
Magnetic or Non-magnetic		Magnetic		Mag.	Magnetic			Magnetic		Non-magnetic		Non-mag.	Magnetic	
Scaling Point, deg. F. Maximum for continuous operation .		1100		1550	1450			1500		1550		1700	1000	

*Wire values are mean of highest and lowest obtainable.

MACHINERY'S Data Sheet No. 267, New Series, February, 1934

Compiled by Ludlum Steel Co., Watervliet, N. Y.

TABLE FOR CONVERTING MINUTES AND SECONDS INTO DECIMALS OF A DEGREE

Minutes into Decimals of a Degree				Seconds into Decimals of a Degree			
Min.	Dec. of Degree	Min.	Dec. of Degree	Sec.	Dec. of Degree	Sec.	Dec. of Degree
1	0.016667	31	0.516667	1	0.000278	31	0.008611
2	0.033333	32	0.533333	2	0.000556	32	0.008889
3	0.050000	33	0.550000	3	0.000833	33	0.009167
4	0.066667	34	0.566667	4	0.001111	34	0.009444
5	0.083333	35	0.583333	5	0.001389	35	0.009722
6	0.100000	36	0.600000	6	0.001667	36	0.010000
7	0.116667	37	0.616667	7	0.001944	37	0.010278
8	0.133333	38	0.633333	8	0.002222	38	0.010556
9	0.150000	39	0.650000	9	0.002500	39	0.010833
10	0.166667	40	0.666667	10	0.002778	40	0.011111
11	0.183333	41	0.683333	11	0.003056	41	0.011389
12	0.200000	42	0.700000	12	0.003333	42	0.011667
13	0.216667	43	0.716667	13	0.003611	43	0.011944
14	0.233333	44	0.733333	14	0.003889	44	0.012222
15	0.250000	45	0.750000	15	0.004167	45	0.012500
16	0.266667	46	0.766667	16	0.004444	46	0.012778
17	0.283333	47	0.783333	17	0.004722	47	0.013056
18	0.300000	48	0.800000	18	0.005000	48	0.013333
19	0.316667	49	0.816667	19	0.005278	49	0.013611
20	0.333333	50	0.833333	20	0.005556	50	0.013889
21	0.350000	51	0.850000	21	0.005833	51	0.014167
22	0.366667	52	0.866667	22	0.006111	52	0.014444
23	0.383333	53	0.883333	23	0.006389	53	0.014722
24	0.400000	54	0.900000	24	0.006667	54	0.015000
25	0.416667	55	0.916667	25	0.006944	55	0.015278
26	0.433333	56	0.933333	26	0.007222	56	0.015556
27	0.450000	57	0.950000	27	0.007500	57	0.015833
28	0.466667	58	0.966667	28	0.007778	58	0.016111
29	0.483333	59	0.983333	29	0.008056	59	0.016389
30	0.500000	60	1.000000	30	0.008333	60	0.016667

MACHINERY'S Data Sheet No. 268, New Series, February, 1934 Contributed by G. W. Amrhein

AMERICAN STANDARD UNFINISHED SQUARE AND HEXAGON NUTS
(Hot or Cold Made)

Diameter of Bolt D	Width Across Flats		Width Across Corners Min.		Thickness Regular Nut			Thickness Regular Jam Nut		
	Maximum (Basic)	Min.	Sq.	Hex.	Nominal	Max.	Min.	Nominal	Max.	Min.
1/4 0.2500	7/16 0.4375	0.425	0.584	0.485	7/32	0.235	0.203	5/32	0.172	0.140
5/16 0.3125	9/16 0.5625	0.547	0.751	0.624	17/64	0.283	0.249	3/16	0.205	0.171
3/8 0.3750	5/8 0.6250	0.606	0.832	0.691	21/64	0.346	0.310	7/32	0.237	0.201
7/16 0.4375	3/4 0.7500	0.728	1.000	0.830	3/8	0.394	0.356	1/4	0.269	0.231
1/2 0.5000	13/16 0.8125	0.788	1.082	0.898	7/16	0.458	0.418	5/16	0.333	0.293
9/16 0.5625	7/8 0.8750	0.847	1.163	0.966	1/2	0.521	0.479	11/32	0.365	0.323
5/8 0.6250	1 1.0000	0.969	1.330	1.104	35/64	0.569	0.525	3/8	0.397	0.353
3/4 0.7500	1 1/8 1.1250	1.088	1.494	1.240	21/32	0.680	0.632	7/16	0.462	0.414
7/8 0.8750	1 5/16 1.3125	1.269	1.742	1.447	49/64	0.792	0.740	1/2	0.526	0.474
1 1.0000	1 1/2 1.5000	1.450	1.991	1.653	7/8	0.903	0.847	9/16	0.591	0.535
1 1/8 1.1250	1 11/16 1.6875	1.631	2.239	1.859	1	1.030	0.970	5/8	0.655	0.595
1 1/4 1.2500	1 7/8 1.8750	1.813	2.489	2.067	1 3/32	1.126	1.062	3/4	0.782	0.718
1 3/8 1.3750	2 1/16 2.0625	1.994	2.738	2.273	1 13/64	1.237	1.169	13/16	0.847	0.779
1 1/2 1.5000	2 1/4 2.2500	2.175	2.986	2.480	1 5/16	1.349	1.277	7/8	0.911	0.839
1 5/8 1.6250	2 7/16 2.4375	2.356	3.235	2.686	1 27/64	1.460	1.384	15/16	0.976	0.900
1 3/4 1.7500	2 5/8 2.6250	2.538	3.485	2.893	1 17/32	1.571	1.491	1	1.040	0.960
1 7/8 1.8750	2 13/16 2.8125	2.719	3.733	3.100	1 41/64	1.683	1.599	1 1/16	1.105	1.021
2 2.0000	3 3.0000	2.900	3.982	3.306	1 3/4	1.794	1.706	1 1/8	1.169	1.081
2 1/4 2.2500	3 3/8 3.3750	3.263	4.480	3.720	1 31/32	2.017	1.921	1 1/4	1.298	1.202
2 1/2 2.5000	3 3/4 3.7500	3.625	4.977	4.133	2 3/16	2.240	2.136	1 1/2	1.552	1.448
2 3/4 2.7500	4 1/8 4.1250	3.988	5.476	4.546	2 13/32	2.462	2.350	1 5/8	1.681	1.569
3 3.0000	4 1/2 4.5000	4.350	5.973	4.959	2 5/8	2.685	2.565	1 3/4	1.810	1.690

MACHINERY'S Data Sheet No. 269, New Series, March, 1934

AMERICAN STANDARD SEMI-FINISHED SQUARE AND HEXAGON NUTS
(Hot or Cold Made)

Diameter of Bolt D	Width Across Flats		Width Across Corners Min.		Thickness Regular Nut			Thickness Regular Jam Nut		
	Maximum (Basic)	Min.	Sq.	Hex.	Nominal	Max.	Min.	Nominal	Max.	Min.
1/4 0.2500	7/16 0.4375	0.425	0.584	0.485	13/64	0.219	0.187	9/64	0.157	0.125
5/16 0.3125	9/16 0.5625	0.547	0.751	0.624	1/4	0.267	0.233	11/64	0.189	0.155
3/8 0.3750	5/8 0.6250	0.606	0.832	0.691	5/16	0.331	0.295	13/64	0.221	0.185
7/16 0.4375	3/4 0.7500	0.728	1.000	0.830	23/64	0.378	0.340	15/64	0.253	0.215
1/2 0.5000	13/16 0.8125	0.788	1.082	0.898	27/64	0.442	0.402	19/64	0.317	0.277
9/16 0.5625	7/8 0.8750	0.847	1.163	0.966	15/32	0.490	0.448	21/64	0.349	0.307
5/8 0.6250	1 1.0000	0.969	1.330	1.104	17/32	0.553	0.509	23/64	0.381	0.337
3/4 0.7500	1 1/8 1.1250	1.088	1.494	1.240	41/64	0.665	0.617	27/64	0.446	0.398
7/8 0.8750	1 5/16 1.3125	1.269	1.742	1.447	3/4	0.776	0.724	31/64	0.510	0.458
1 1.0000	1 1/2 1.5000	1.450	1.991	1.653	55/64	0.887	0.831	35/64	0.575	0.519
1 1/8 1.1250	1 11/16 1.6875	1.631	2.239	1.859	31/32	0.999	0.939	39/64	0.639	0.579
1 1/4 1.2500	1 7/8 1.8750	1.813	2.489	2.067	1 1/32	1.063	0.999	11/16	0.720	0.656
1 3/8 1.3750	2 1/16 2.0625	1.994	2.738	2.273	1 9/64	1.175	1.107	3/4	0.784	0.716
1 1/2 1.5000	2 1/4 2.2500	2.175	2.986	2.480	1 1/4	1.286	1.214	13/16	0.849	0.777
1 5/8 1.6250	2 7/16 2.4375	2.356	3.235	2.686	1 23/64	1.397	1.321	7/8	0.913	0.837
1 3/4 1.7500	2 5/8 2.6250	2.538	3.485	2.893	1 15/32	1.509	1.429	15/16	0.978	0.898
1 7/8 1.8750	2 13/16 2.8125	2.719	3.733	3.100	1 37/64	1.620	1.536	1	1.042	0.958
2 2.0000	3 3.0000	2.900	3.982	3.306	1 11/16	1.732	1.643	1 1/16	1.107	1.019
2 1/4 2.2500	3 3/8 3.3750	3.263	4.480	3.720	1 29/32	1.954	1.858	1 3/16	1.236	1.140
2 1/2 2.5000	3 3/4 3.7500	3.625	4.977	4.133	2 3/32	2.146	2.042	1 13/32	1.458	1.354
2 3/4 2.7500	4 1/8 4.1250	3.988	5.476	4.546	2 5/16	2.369	2.257	1 17/32	1.587	1.475
3 3.0000	4 1/2 4.5000	4.350	5.973	4.959	2 17/32	2.591	2.471	1 21/32	1.716	1.596

MACHINERY'S Data Sheet No. 270, New Series, March, 1934

AMERICAN STANDARD FINISHED HEXAGON REGULAR NUTS AND JAM NUTS

Diameter of Bolt D		Width Across Flats			Width Across Corners	Thickness Regular Nut			Thickness Regular Jam Nut		
		Maximum (Basic)		Min	Min	Nominal	Max	Min	Nominal	Max	Min
1/4	0.2500	7/16	0.4375	0.428	0.488	7/32	0.225	0.212	5/32	0.163	0.150
5/16	0.3125	9/16	0.5625	0.552	0.629	17/64	0.273	0.258	3/16	0.195	0.180
3/8	0.3750	5/8	0.6250	0.613	0.699	21/64	0.336	0.320	7/32	0.227	0.211
7/16	0.4375	3/4	0.7500	0.737	0.840	3/8	0.384	0.366	1/4	0.259	0.241
1/2	0.5000	13/16	0.8125	0.799	0.911	7/16	0.448	0.428	5/16	0.323	0.303
9/16	0.5625	7/8	0.8750	0.861	0.982	1/2	0.511	0.489	11/32	0.355	0.333
5/8	0.6250	1	1.0000	0.985	1.123	35/64	0.559	0.535	3/8	0.387	0.363
3/4	0.7500	1 1/8	1.1250	1.108	1.263	21/32	0.670	0.642	7/16	0.451	0.424
7/8	0.8750	1 5/16	1.3125	1.293	1.474	49/64	0.781	0.750	1/2	0.516	0.484
1	1.0000	1 1/2	1.5000	1.479	1.686	7/8	0.893	0.858	9/16	0.580	0.545
1 1/8	1.1250	1 11/16	1.6875	1.665	1.898	1	1.020	0.980	5/8	0.644	0.606
1 1/4	1.2500	1 7/8	1.8750	1.850	2.109	1 3/32	1.115	1.072	3/4	0.771	0.729
1 3/8	1.3750	2 1/16	2.0625	2.036	2.321	1 13/64	1.227	1.180	13/16	0.836	0.789
1 1/2	1.5000	2 1/4	2.2500	2.222	2.533	1 5/16	1.338	1.288	7/8	0.900	0.850
1 5/8	1.6250	2 7/16	2.4375	2.407	2.744	1 27/64	1.449	1.395	15/16	0.965	0.910
1 3/4	1.7500	2 5/8	2.6250	2.593	2.956	1 17/32	1.560	1.503	1	1.029	0.971
1 7/8	1.8750	2 13/16	2.8125	2.778	3.168	1 41/64	1.672	1.610	1 1/16	1.094	1.031
2	2.0000	3	3.0000	2.964	3.379	1 3/4	1.783	1.718	1 1/8	1.158	1.093
2 1/4	2.2500	3 3/8	3.3750	3.335	3.802	1 31/32	2.005	1.932	1 1/4	1.286	1.214
2 1/2	2.5000	3 3/4	3.7500	3.707	4.226	2 3/16	2.228	2.148	1 1/2	1.540	1.460
2 3/4	2.7500	4 1/8	4.1250	4.078	4.649	2 13/32	2.450	2.363	1 5/8	1.669	1.581
3	3.0000	4 1/2	4.5000	4.449	5.072	2 5/8	2.673	2.578	1 3/4	1.798	1.703

MACHINERY'S Data Sheet No. 271, New Series, April, 1934

DIMENSIONS FOR OPEN-END WRENCH OPENINGS

Nominal Size of Wrench also Basic Width Across Flats, Bolt Heads and Nuts W		Allowance between Bolt Head or Nut and Jaws of Wrench	Wrench Opening			Nominal Bolt Diameter				
			Min	Tolerance	Max	Regular Series		Heavy Series	Light Series	Cap Screws
						Bolts, Unfinished and Semi-finished	Bolts, Finished — Nuts and Jam Nuts, Unfinished, Semi-finished and Finished	Bolts, Nuts and Jam Nuts, Unfinished, Semi-finished and Finished	Nuts and Castle Nuts	
5/32	0.1562	0.002	0.158	0.005	0.163	...	...	...	...	...
3/16	0.1875	0.002	0.189	0.005	0.194	...	...	...	...	...
1/4	0.2500	0.002	0.252	0.005	0.257	...	...	...	...	...
5/16	0.3125	0.003	0.315	0.006	0.321	...	...	...	...	...
11/32	0.3437	0.003	0.347	0.006	0.353	...	...	...	...	...
3/8	0.3750	0.003	0.378	0.006	0.384	1/4	...	...	...	...
7/16	0.4375	0.003	0.440	0.006	0.446	5/16	1/4	...	1/4	...
1/2	0.5000	0.003	0.503	0.006	0.509	3/8	5/16	...	5/16	...
9/16	0.5625	0.004	0.566	0.007	0.573	7/16	3/8	...	3/8	...
5/8	0.6250	0.004	0.629	0.007	0.636	1/2	7/16	...	7/16	...
3/4	0.7500	0.005	0.755	0.008	0.763	9/16	1/2	...	1/2	...
7/8	0.8125	0.005	0.817	0.008	0.825	5/8	9/16	...	9/16	...
7/8	0.8750	0.005	0.880	0.008	0.888	11/16	5/8	...	5/8	...
15/16	0.9375	0.006	0.943	0.009	0.952	...	...	...	...	...
1	1.0000	0.006	1.006	0.009	1.015	3/4	3/4	3/4	3/4	3/4
1 1/16	1.0625	0.006	1.068	0.009	1.077	13/16	13/16	13/16	13/16	13/16
1 1/8	1.1250	0.007	1.132	0.010	1.142	7/8	7/8	7/8	7/8	7/8
1 3/16	1.2500	0.007	1.257	0.010	1.267	15/16	15/16	...	15/16	...
1 1/4	1.3125	0.008	1.320	0.011	1.331	1	1	1	1	1
1 5/16	1.3750	0.008	1.383	0.011	1.394	...	...	...	...	...
1 7/16	1.4375	0.008	1.445	0.011	1.456	...	...	...	...	...
1 1/2	1.5000	0.008	1.508	0.012	1.520	1	1	1	1	1
1 9/16	1.5625	0.009	1.634	0.012	1.646	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16
1 5/8	1.6875	0.009	1.696	0.012	1.708	1 1/8	1 1/8	1 1/8	1 1/4	1 1/8
1 11/16	1.8125	0.010	1.822	0.013	1.835	1 1/4	1 1/4	...	...	...
1 7/8	1.8750	0.010	1.885	0.013	1.898	...	...	...	...	...
2	2.0000	0.011	2.011	0.014	2.025	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8
2 1/16	2.0625	0.011	2.073	0.014	2.087	1 7/16	1 7/16	1 7/16	1 7/16	1 7/16
2 3/16	2.1875	0.012	2.199	0.015	2.214	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2
2 1/4	2.2500	0.012	2.262	0.015	2.277	...	...	...	...	...
2 5/16	2.3750	0.013	2.388	0.016	2.404	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8
2 7/16	2.4375	0.013	2.450	0.016	2.466	...	...	...	...	...
2 9/16	2.5625	0.014	2.576	0.017	2.593	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4
2 5/8	2.6250	0.014	2.639	0.017	2.656	...	...	...	...	...
2 3/4	2.7500	0.015	2.765	0.018	2.783	1 7/8	1 7/8	1 7/8	1 7/8	1 7/8
2 13/16	2.8125	0.015	2.827	0.018	2.845	...	...	...	...	...
2 15/16	2.9375	0.016	2.953	0.019	2.972	...	...	...	...	...

MACHINERY'S Data Sheet No. 272, New Series, April, 1934

Based on American Standard Approved March, 1933.

MACHINERY'S DATA SHEETS 273 and 274

COMPOSITION AND APPLICATION OF ALLOY STEELS—1

Type of Steel	Basic Composition						Use
	Carbon	Manganese	Silicon	Tungsten	Chromium	Vanadium	
Carbon Tool Steel	0.70–1.30	0.25	0.25	....	....	....	Tools, dies, and wearing parts for small machines
Carbon-Vanadium Tool Steel	0.70–1.30	0.25	0.25	....	....	0.15	Miscellaneous tools and dies, and wearing parts for small machines
Chrome-Vanadium Tool Steel	0.50–0.90	0.25	0.25	....	0.80	0.15	Miscellaneous tools and dies, and wearing parts for small machines, such as shafts, spindles, collets, etc.
Low-Tungsten Tool Steel	0.50	0.25	0.25	2.00	1.75	0.15	Chisels, punches, shear blades
Silicon-Manganese Tool Steel	0.50	0.80	2.00	....	....	....	Chisels, punches, shear blades; also springs, etc.
Oil-Hardening Tool Steel, Manganese Type	0.90	1.25	....	0.50	0.50	0.15	Miscellaneous dies for blanking and forming
Oil-Hardening Tool Steel, Tungsten Type	1.25	0.25	0.25	1.50	0.50	....	Miscellaneous dies for blanking and forming
Chromium Hot-Work Die Steel	0.90	0.25	0.25	....	3.75	....	Gripper and similar dies for hot work
High-Carbon High-Chromium Die Steel	2.25	0.25	0.25	....	12.00	....	Blanking dies, shear blades, punches, etc.

MACHINERY'S Data Sheet No. 273, New Series, May, 1934

Based on Practice of Well-known Manufacturer of High-speed, Carbon, and Alloy Steels

COMPOSITION AND APPLICATION OF ALLOY STEELS—2

Type of Steel	Basic Composition								Use
	Carbon	Manganese	Silicon	Tungsten	Chromium	Vanadium	Molybdenum	Nickel	
High-Carbon High-Chromium Die Steel. Air-Hardening Type	1.60	0.25	0.25	.....	12.00	.....	0.75	....	Blanking dies, shear blades, punches, body dies, etc.
Finishing Steel	1.25	0.25	0.25	4.00	....	....	....	....	Tools for fine and smooth cutting
Tungsten Hot-Work Die Steel	0.30	0.25	0.25	10.00	3.50	0.50	....	....	General-purpose hot-working die steel
High-Speed Steel	0.70	0.25	0.25	18.00	4.00	1.00	....	....	Miscellaneous tools; cutting, blanking and forming tools
Cobalt High-Speed Steel*	0.75	0.25	0.25	18.00	4.00	1.00	....	....	Miscellaneous cutting tools
Die-Block	0.50–0.70	0.50–0.80	0.20	.....	0.75	....	....	1.50	Die-blocks
Trimmer Steel	0.85	0.25	0.25	.....	0.50	....	....	0.30	Shear blades and trimming dies
Nitralloy†	0.20–0.40	0.50	0.25	.....	1.40	....	0.30	....	Parts to be nitrided
Nitralloy†	0.20–0.40	0.50	0.25	.....	.....	....	0.80	....	Parts to be nitrided

*Contains 4 to 12 per cent cobalt. †Contains 1.20 per cent aluminum.

MACHINERY'S Data Sheet No. 274, New Series, May, 1934

Based on Practice of Well-known Manufacturer of High-speed, Carbon, and Alloy Steels

MATERIALS THAT CAN BE HARD-FACED

The economies made possible by hard-facing may be summarized as follows: Longer life of equipment; fewer replacements, with resulting savings in labor charges; reduction in loss of production time; utilization of cheaper base metal for wearing parts; the possibility of salvaging or reclaiming worn parts; savings in power consumption; and general increase in operating efficiency. According to data compiled by the Haynes Stellite Co., such hard-facing materials as Hascrome, Haynes Stellite and Haystellite Composite Rod can be applied to the metals and alloys included in the following lists.

Steels that can be Hard-Faced

Carbon Steels—This class includes all straight carbon steels up to 0.60 per cent carbon. These can be hard-faced, both by the oxy-acetylene and electric arc processes, in practically all instances.

High-Carbon Steels—This group includes steels with carbon above 0.60 per cent. Proper heat-treatment both before and after hard-facing is necessary; otherwise, difficulties may be experienced in failure of the base metal, because of its extreme hardness and brittleness.

Low Alloy Steels—Hard-facing alloys can be applied to low alloy steels in very much the same manner as to straight carbon steels, but in some cases, heat-treatment is required after welding.

High-Speed Steel—The hard-facing of this group of steels is not generally recommended. While they can easily be hard-faced, shrinkage and strain checks are likely to interfere with the successful use of the hard-faced piece, regardless of heat-treatment.

Manganese Steel—The metallic arc is always used in hard-facing manganese steel.

Stainless Steels—This group, which includes the high-chromium steels and the 18-8 chrome-nickel steels, can be readily hard-faced.

Hascrome—Haynes Stellite and Composite Rod are readily applied to Hascrome by either the oxy-acetylene or the electric arc process.

Cast Irons that can be Hard-Faced

Cast Iron—Cast iron can be hard-faced with either the oxy-acetylene or the electric arc process, although the procedure is somewhat different from that for steel, because of the lower melting point of cast iron.

Chilled Iron—Small chilled-iron parts can be hard-faced the same as cast iron. On larger parts difficulty is usually encountered.

Alloy Cast Iron—The same procedure should be used as for hard-facing ordinary gray iron.

Non-Ferrous Materials that can be Hard-Faced

Monel Metal—Monel metal is easily hard-faced by the oxy-acetylene process.

Haynes Stellite—Obviously this alloy is easily welded to itself, as in rebuilding surfaces that have already been stellited.

Materials Difficult or Impossible to Hard-Face

Brass and Bronze—Because of their low melting points, these alloys cannot generally be hard-faced. In a few rare instances, heavy sections that have been preheated to a red heat have been stellited by means of the metallic arc.

Copper—Because of its low melting point and heat conductivity, it is difficult for copper to be stellited by the oxy-acetylene process. Preheating copper to a red heat and applying Haynes Stellite with the metallic arc is the preferable method.

Aluminum—Aluminum or its alloys cannot be hard-faced by either the oxy-acetylene or the electric arc process.

MACHINERY'S Data Sheet No. 275, New Series, June, 1934

DATA ON HOLLOW SET-SCREWS AND SOCKET-HEAD CAP-SCREWS

(Applies to Hardened Set-Screws Bearing against Softer Metal)

Proper Size Relationship between Cup-Point Set-Screw and Shaft Diameter
Recommended Tightening Force and Holding Power for Different Sizes of Set-Screws

Size or Diameter of Set-Screws	No. 10	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
Shaft Diameter, Inches	1/4 to 7/8	7/8 to 1 1/2	1 1/4 to 1 3/4	1 1/2 to 1 3/4	1 3/4 to 2	2 to 2 3/4	2 1/2 to 3	3 to 4	4 to 5	4 1/2 to 6
Recommended Tightening Force, Inch-Pounds	...	65	150	200	300	500	800	1500	2000	3000
Holding Power on Shafts*	...	775 to 1030	1710 to 2130	2090 to 2290	2740 to 2975	3610 to 4430	4600 to 5170	6330 to 7700	7800 to 9000	8900 to 10750
Holding Power on Flat Surface, Pounds	...	1150	2240	3000	3750	6150	8950	12500	14000	16300

*The holding power of the set-screw is expressed in pounds at the surface of the shaft, and depends on the size of the shaft. The approximate holding power for intermediate size shafts may be obtained by interpolation.

Recommended Tightening Force for Cap-Screws, in Inch-Pounds

	...	200	300	800	800	1500	2000	3000	3000	...

MACHINERY'S Data Sheet No. 276, New Series, June, 1934

Based on copyrighted data furnished by the Allen Mfg. Co., Hartford, Ct.

AVERAGE HORSEPOWER REQUIREMENTS OF MACHINE TOOLS—1

Engine Lathes
Motor, Sq.Cg.-C.S. or M.S.4-V.S.

Swing, In.	Average	Heavy
14	2	3
16	3	5
18	5	7 1/2
20	7 1/2	10
24	10	15
30	15	20
36	20	25
42	20	25
48	25	30
60	30	40

Planers, Reciprocating
A.C.-D.C. Motor-Generator Set with D.C. Motor Drive and Control

Size, In.	Average	Heavy
24x 24	5	7 1/2
30x 30	7 1/2	10
36x 36	15	20
48x 48	20	30
60x 60	30	50
72x 72	40	50
84x 84	50	60
100x100	50	75

Milling Machines
Motor, Sq.Cg.-C.S. or M.S.4-V.S.

Table Feed, In.	Average	Heavy
Universal		
22x 8	2	3
28x10	3	5
34x12	5	7 1/2
42x14	7 1/2	10
60x15	10	15
Plain		
22x 8	3	5
28x10	5	7 1/2
34x12	7 1/2	10
42x14	10	15
60x15	15	20

Horizontal Slab Millers

Width between Housings, In.	Average	Heavy
16	5	7 1/2
18	7 1/2	10
20	10	15
24	20	30
30	25	40
36	40	50

Drilling Machines
Motor, Sq.Cg.-C.S. or M.S.4-V.S.

	Average	Heavy
Upright		
Size, In.		
12-20	3/4	1
24-28	1	2
30-32	2	3
36-40	3	5
50-60	5	7 1/2
Radial Arm, In.		
36	3	5
48	5	7 1/2
60	7 1/2	10
72	10	15
96	20	25

Multiple Spindle

Size Drills, Inches	No. Spindles	Average	Heavy
3/32-1/4	6-10	3	5
3/16-1/2	6-10	5	7 1/2
1/4-3/4	6-10	7 1/2	10
3/8-1	6-10	10	15
2	6	7 1/2	10
2	8	10	15

Abbreviations { Sq. Cg., Squirrel Cage C.S., Constant Speed
M.S.4, Multi-speed-4 Speeds V.S., Variable Speed

MACHINERY'S Data Sheet No. 277, New Series, July, 1934 — Contributed by George H. Hall

AVERAGE HORSEPOWER REQUIREMENTS OF MACHINE TOOLS—2

Boring and Turning Mills
Motor, Sq.Cg.-C.S. or M.S.4-V.S.
Cross-Rail Motor, Sq.Cg.-H.T.-C.S.

Size	Main		Cross-Rail
	Average	Heavy	
42 in.	7 1/2	10	...
50	10	15	...
60	15	20	5
72	20	25	5
84	20	25	5
96	25	30	5
10 ft.	30	40	7 1/2
12	30	40	7 1/2
14	30	50	7 1/2
18	40	50	10
25	50	60	10
30	60	75	15

Cylinder Boring Machines
Motor, Sq.Cg.-C.S. or M.S.4-V.S.

Dia. Spindle, In.	Dia. Max. Bore, In.	Average	Heavy
4	20	7 1/2	10
6	30	10	15
8	40	15	20

Grinding Wheels (Double-End)
Motor, Sq.Cg.-C.S.

Wheel, In.	Average	Heavy
6x3/8	1/4	1/2
8x1	1/2	1
10x1	1	2
12x2	3	5
18x3	5	7 1/2
24x4	7 1/2	10
26x4	10	15
30x4	15	20

Cylindrical Grinders
Motor, Sq.Cg.-C.S.

Dia. Wheel, In.	Average	Heavy
10	5	7 1/2
14	10	15
18	15	20
24	20	25
30	30	40

Vertical Surface Grinders
Motor, Sq.Cg.-C.S.

Dia. Table, In.	Average	Heavy
8	5	7 1/2
14	10	15
30	15	20

Pipe Threaders and Cutters
Motor, Sq.Cg.-H.T.-C.S. or Sl.Rg.V.S.

Pipe Size Up to	Average	Heavy
1 in.	2	3
2	2	3
3	3	5
4	3	5
6	5	7 1/2
8	7 1/2	10
10	7 1/2	10
12	10	15

Gear Cutters
Motor, Sq.Cg.-C.S. or M.S.4-V.S.

Size, In.	Average	Heavy
24x 6	1 1/2	2
36x 9	2	3
48x10	3	5
30x12	5	7 1/2
60x12	5	7 1/2
72x14	7 1/2	10
64x20	10	15

Shapers
Motor, Sq.Cg.-C.S. or M.S.4-V.S.

Stroke, In.	Average	Heavy
12-18	2	5
20-24	5	7 1/2
28-30	7 1/2	10

Abbreviations { Sq. Cg., Squirrel Cage C.S., Constant Speed
Sl. Rg., Slip Ring V.S., Variable Speed
M.S.4, Multi-speed-4 Speeds H.T., High Starting Torque

MACHINERY'S Data Sheet No. 278, New Series, July, 1934 — Contributed by George H. Hall

MACHINERY'S DATA SHEETS 279 and 280

THE A-B-C OF STAINLESS STEEL—1

Compiled by The Carpenter Steel Co., Reading, Pa.

Group A	Group B	Group C
Analysis Groups A and B are primarily straight chromium steels. Multiply the per cent of carbon in the steel by 17. Subtract this from the per cent of chromium in the steel. If the result is less than 12.5 per cent, the steel belongs to Group A; if greater than 12.5 per cent, it belongs to Group B. Either group may contain small percentages of copper, nickel, silicon, molybdenum, sulphur, etc., for special purposes.		Contains at least 24 per cent of chromium and nickel combined. Neither chromium nor nickel should be less than 8 per cent. May contain small percentages of other elements for special purposes.
Magnetic Properties This group is magnetic.	This group is magnetic.	This group is non-magnetic.
Heat-Treatment Respond to hardening and tempering like ordinary steels. Resulting physical properties depend largely on carbon content.	Do not respond to hardening by heat-treatment.	Do not respond to hardening by heat-treatment.
Toughness Are structurally dependable. Are not brittle in sharp-notched sections or under impact.	Have low impact resistance, especially in notched sections.	Extremely tough at all times. Thoroughly dependable for any type of shock service within the capacity of their strength.
Grain Growth at High Temperatures Not subject to excessive grain growth at elevated temperatures. Remain tough at all temperatures up to 1400 degrees F.	Prolonged exposure to elevated temperatures usually causes excessive grain growth and brittleness.	Grain growth is rapid above 1800 degrees F. Caution must be used for operating temperatures between 800 degrees and 1500 degrees F. Metallurgists should be consulted when this grade of steel must be heated, either during its fabrication or use.

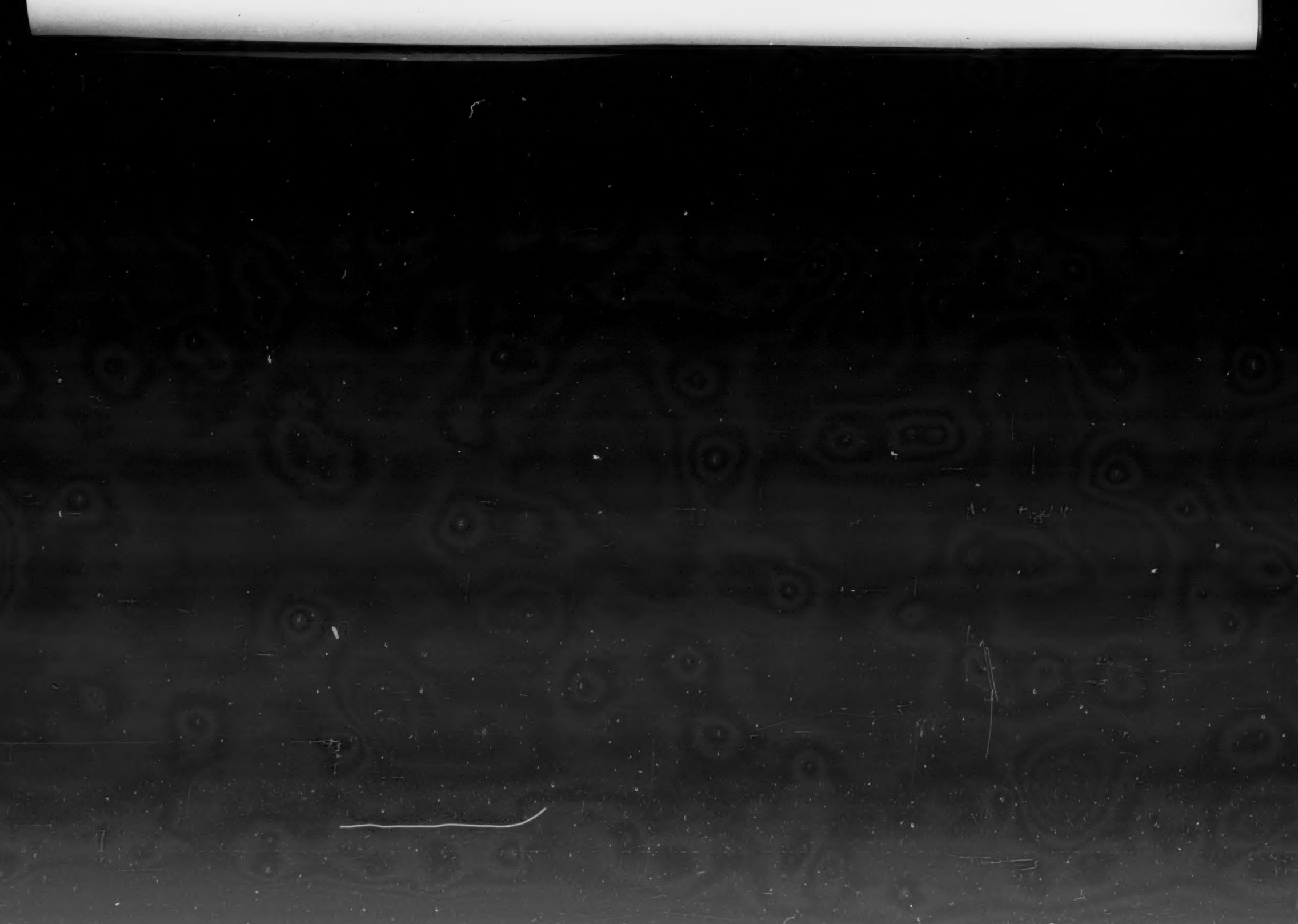
MACHINERY'S Data Sheet No. 279, New Series, August, 1934

THE A-B-C OF STAINLESS STEEL—2

Compiled by The Carpenter Steel Co., Reading, Pa.

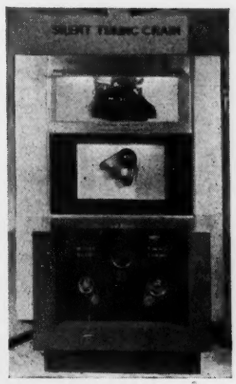
Group A	Group B	Group C
Analysis Groups A and B are primarily straight chromium steels. Multiply the per cent of carbon in the steel by 17. Subtract this from the per cent of chromium in the steel. If the result is less than 12.5 per cent, the steel belongs to Group A; if greater than 12.5 per cent, it belongs to Group B. Either group may contain small percentages of copper, nickel, silicon, molybdenum, sulphur, etc., for special purposes.		Contains at least 24 per cent of chromium and nickel combined. Neither chromium nor nickel should be less than 8 per cent. May contain small percentages of other elements for special purposes.
Hot-Working Properties Readily forged, pierced, or rolled.	Readily forged, pierced, or rolled.	Readily forged, pierced, or rolled.
Air-Hardening This group air-hardens from above 1500 degrees F.	Does not appreciably air-harden.	Does not air-harden at all.
Cold-Working Qualities Can be cold-drawn into wire, cold-rolled, bent, formed, upset, coined, and deep drawn.	Can be cold-drawn into wire, cold-rolled, bent, formed, upset, coined, and deep drawn.	Can be cold-drawn into wire, cold-rolled, bent, formed, upset, coined, and deep drawn. Work-hardens twice as rapidly as Groups A and B.
Machineability Machine satisfactorily with properly designed tools. High-sulphur types machine like Bessemer screw stock.	Machine satisfactorily with properly designed tools.	Very difficult to machine. Become free-machining when sulphur or selenium are added to the analysis.
Riveting Make excellent cold rivets. Not recommended for hot rivets driven above 1500 degrees F. on account of air-hardening.	Due to low impact values, special precautions are necessary when used for rivets.	Excellent for either hot or cold rivets. Hot rivets should be heated all over to at least 1800 degrees F.

MACHINERY'S Data Sheet No. 280, New Series, August, 1934



POWER TRANSMISSION NEWS

Stroboscope at the World's Fair

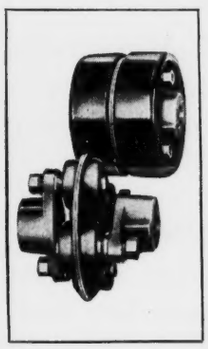


To show the slow movement and smooth action of Morse Silent Chains, the stroboscope is used by the Morse Chain Company in the Borg-Warner exhibit in the Travel and Transport Building at the Century of Progress.

New Application of Rubber in Power Transmission

A comparatively new type of flexible coupling is coming into more general use in connecting shafting and is replacing the conventional universal joint where the angular misalignment is not excessive.

The coupling consists of two forged steel hub members mounted on the shafts to be connected. Between these is carried the floating center to which each hub is separately connected through a pair of resilient rubber trunnion blocks. These trunnion blocks, 90° apart, are set under pressure into a two-piece riveted housing of pressed steel. The blocks are molded over and permanently fastened to steel cores, or bushings. These steel cores, in opposite pairs, are rigidly bolted to the end hub members of the coupling.



The especially developed resilient non-cold-flow rubber blocks are responsible for the extreme flexibility of the coupling, providing for greater parallel and angular misalignment than any other coupling. These rubber blocks are all on a common center, equally radial from a common axis, consequently this coupling, at any angle, will run smoothly and true.

This is known as the "Morflex" coupling and is made by the Morse Chain Company, of Ithaca, N. Y. They cite as an example of its efficiency a recent installation, joining a motor and generator. Before this coupling was put on, a semi-universal was in use, which was noisy and apparently absorbed a lot of power, causing the motor to heat badly and causing difficulty with the bearings.

After the "Morflex" coupling was installed, the noise disappeared, the motor ran cool and the owner's coupling troubles were over.

As there is no metal-to-metal in the assembly, there is no rattle or wear, consequently no lubrication is ever required. Furnished in a variety of popular sizes, for from ⅜" to 3" shaft diameters.

20 Years of Service

By the time any piece of equipment has rendered 20 years of service in any one plant, it may be regarded as an old friend. A prominent knitting mill in Rockford, Ill. (name on request), has 40 such friends in the shape of 40 Morse Silent Chain Drives that have been running for a generation. These are 2½" units, transmitting 13 h.p. between 17 and 49 tooth sprockets.

Chain Drives

UNDER ALL CONDITIONS

MEET every transmission demand. Flexible, no power loss, low maintenance cost, low first cost, long life, chain drives give you definite performance and operating economies. Adaptable, can be applied to centers you want.

Ask Morse engineers for further information on the specific application of chain drives to your transmission needs.

MORSE CHAIN COMPANY

A Division of Borg-Warner Corporation

ITHACA, NEW YORK

Let's Look at the Record

Mr. Manufacturer, the editorial columns of *Machinery* are a black and white record of the far reaching developments you and other manufacturers have made during the past four years.

The articles and descriptions we have published show new machines, equipment and materials valued at millions of dollars. These developments represent money invested by you to build a product more readily salable.

With this huge amount on the *development* side of your scale, with products right up to scratch, it is reasonable to bring the *selling* side into more even balance—to provide appropriations for selling and advertising that will make your real objective—*sales*—more easily reached.

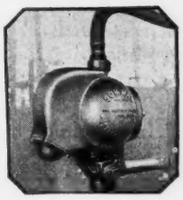
Why not talk over with us the markets and individuals you would like to reach?

MACHINERY

140-148 LAFAYETTE STREET, NEW YORK, N. Y.

SAVE

44% On Grinding Wheels



87% On Wheel Dressings

By Filtering Your Coolant

The SORWAL Coolant FILTER has been making just such remarkable savings for some of the most prominent manufacturers in the country — names which read like a Blue Book of American industry.

Results of tests recently completed in the Robinson Laboratories of Ohio State University show increased capacity up to 65.8% and decreased wheel dressings up to 87.5%. Separate reports were made on grinding steel, cast iron, brass and aluminum.

We will be glad to send you complete copies of any of these reports you may be interested in, or any special information you may require. Write today.

THE FOSTORIA PRESSED STEEL CORP.
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Manufacturers of
SORWAL COOLANT FILTER

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for **DRILL PRESSES**
Large Holes at Low Cost

Accurate enough for drill press use. Strong enough to stand up on steady production work MARVEL HOLE SAWS cut cost of large holes. They increase the capacity of small drill presses for they require less power than equivalent sizes in drills. Genuine 18% Tungsten High Speed Steel edge . . . Unbreakable alloy steel body..

MARVEL
High-Speed-Edge
HOLE SAWS

Manufactured and Guaranteed by makers of the patented, unbreakable MARVEL High - Speed - Edge Hack Saw Blades.

Armstrong-Blum Mfg. Co.
"The Hack Saw People"
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Pleasure to Use
NORMAL BEAM COMPASS
Made for draftsmen. Light, yet stiff. Positive adjustment about 3/8". Popular wherever used.

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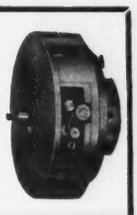
E. LAWRENZ, 2533 McClellan Ave., DETROIT, MICH.

Face While Boring

M-D Facing Head can be attached to Column Boring Bar, and Drilling or Milling Machine spindles. Single point tool travels radially, from center outward or reverse, feeds automatically, and covers faces 6" to 30". Write for prices.



MUMMERT-DIXON COMPANY
HANOVER, PA.

Here it is!
ATKINS SILVER STEEL SAW

The Blade that stops Waste

Here's what you need in a hacksaw—ready to prove its value to you. Here's the hacksaw that makes every working minute count, and makes more cuts per blade than any others, at less cost.

Try ATKINS SILVER STEEL "Blue End" Hacksaws in your own shop and convince yourself that only ATKINS have what it takes to meet every metal cutting problem successfully. Then concentrate your hacksaw purchases on ATKINS, "THE FINEST ON EARTH."

ATKINS SILVER STEEL Blades are easily identified by the BLUE END. See your distributor.

E. C. ATKINS AND COMPANY
INDIANAPOLIS, IND.

ANNOUNCEMENT

In 1911 we originated and put on the market the first Socket Head Cap Screw.

Again we are the pioneers because now we are introducing **UNBRAKO** the *first and only* Socket Head Cap Screw with a *Knurled Head* ever made. It will be known as the Knurled "Unbrako" of which we make a complete line.

Socket Head Cap Screw

Fig. 1434

NEW

Its Head Is Knurled

Fig. 1435

U. S. and Foreign Pats. Pending

The Knurled "Unbrako"

Fingers become geared to the knurled head so they can't slip, which makes the Knurled "Unbrako" a real time and labor saver.

NEW

Its Head Is Knurled

Fig. 1436

Old Smooth-Head

Fingers slip and slide. Hard and slow to drive.

U. S. and Foreign Pats. Pending

The Knurled "Unbrako"

Every mechanic, when driving screws, will invariably use his fingers as much as possible, because they are much handier than any wrench and save time.

With the Knurled "Unbrako" he can drive much faster than before, as his fingers actually become geared to the Knurled Head so they can't slip and, therefore, get a much better purchase regardless of how greasy the head might be.

Smooth Head Screws, on the other hand, are hard to get hold of and, therefore, much slower to drive.

In many intricate dies it might save a great deal of time and labor that the Knurled "Unbrako" can be easily and quickly pinched home and backed off with a pair of pliers; with smooth head screws this would, at best, be next to impossible to do.

We have shown the Knurled "Unbrako" to some of the foremost Die and Tool makers in the country and they are all very strong for it.

The Knurled "Unbrako" is of exactly the same high quality as the smooth head "Unbrako."

The Knurled "Unbrako" Costs No More than Smooth Heads and Looks Much Neater.
Order by Name—Specify the Knurled "Unbrako". Free Samples.

STANDARD PRESSED STEEL CO.

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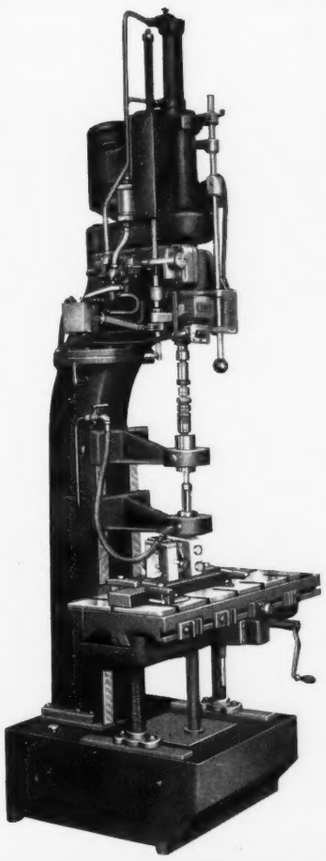
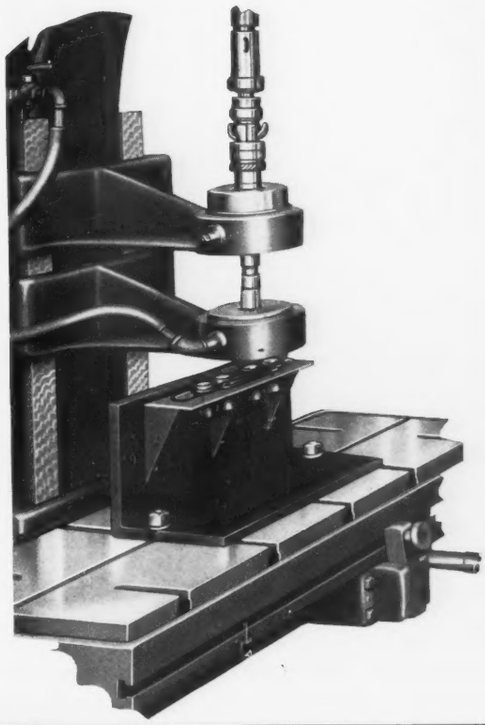


FOR Small HONING And LARGE SAVING



Self-Oiling, All-Geared Internal Honer No. 194, illustrated, has hydraulic reciprocation, full-automatic cycle, patented electric stroke-counter, and indexing table for honing electric refrigerator compressor-cylinders to an accurate mirror finish in 15 seconds. This machine effects large savings and improves quality on a wide variety of similar products.

At right is a No. 194 set-up for honing valve lifter bearings. This recent development now makes practical accurate high-speed finishing of small parts having holes that are relatively shallow as compared to their diameter.

Investigate, if you finish cylinders, liners, bearings, bushings, or other bores —small or large. See how Self-Oiling, All-Geared Internal Honing can make large savings on your work.

Write today for Catalog M.

BARNES DRILL CO.

814 Chestnut Street

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BARBER-COLMAN REAMERS

FOR HOLES THAT **MUST** BE

ROUND
SMOOTH
STRAIGHT
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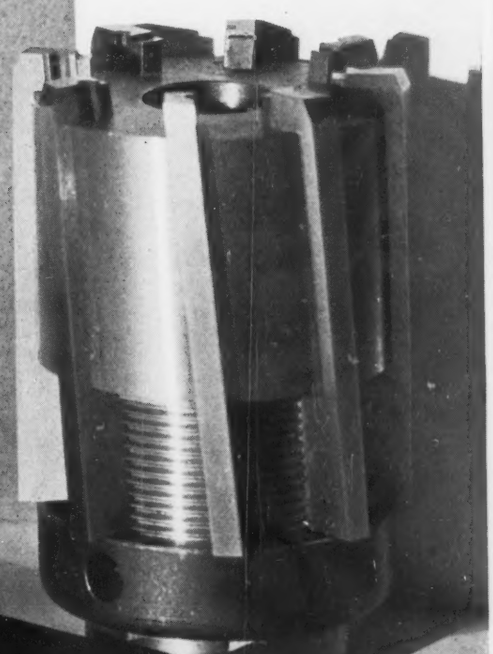

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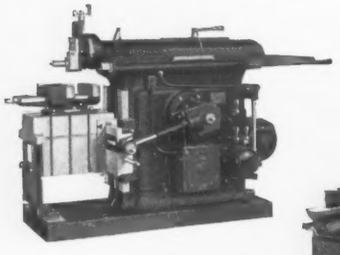
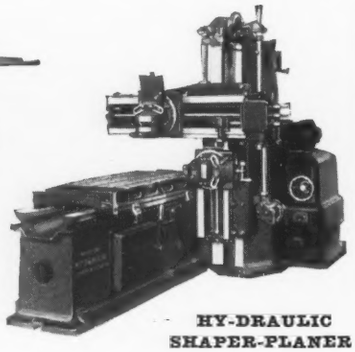
General Offices and Plant ROCKFORD, ILLINOIS, U. S. A.

Made in ROCKFORD ILL., U. S. A.

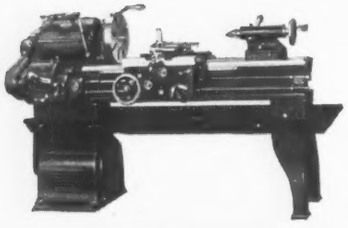
PRACTICAL TOOLS for MODERN SHOPS



HY-SERVICE SHAPERS

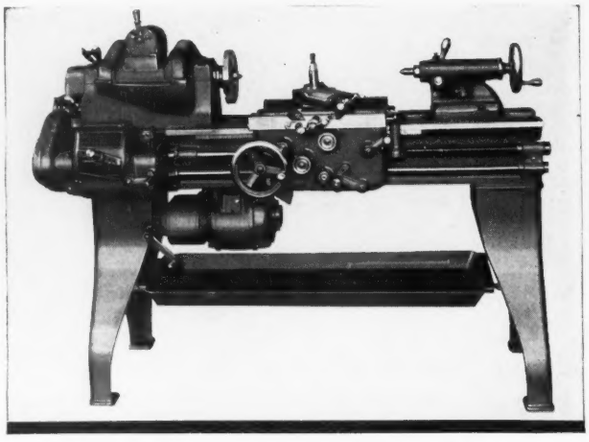


HY-DRAULIC SHAPER-PLANER



ECONOMY GEARED HEAD

Complete descriptions, specifications, and prices on any or all of these machines sent to you promptly on request. Keep your files up to date—write today for latest circulars.



SPECIAL ECONOMY LATHE

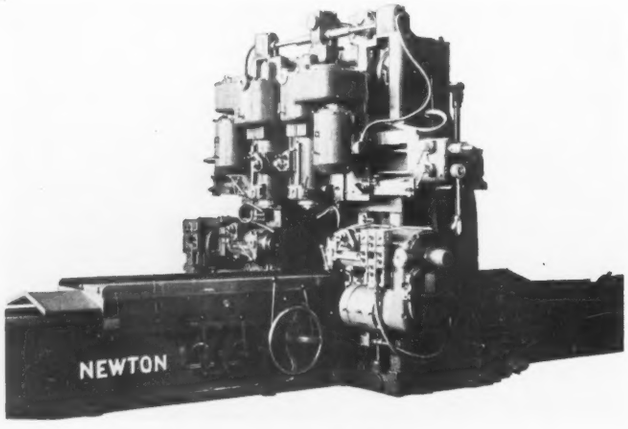
Rockford Economy Lathes, Hy-Service Shapers and Hy-Draulic Shaper-Planers are thoroughly practical, widely used in commercial service, safe, dependable, low in price—ideal for any shop, large or small.

ROCKFORD MACHINE TOOL CO.

LATHES · SHAPERS · SHAPER-PLANERS

ROCKFORD, ILLINOIS, U. S. A.

PULLMORE CLUTCHES USED ON



NEWTON
4-Spindle Unit-Head Planer-Type MILLING MACHINE

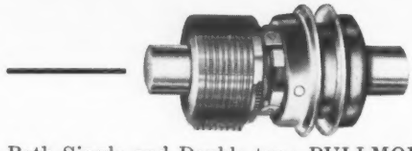
"THE PULLMORE CLUTCH, AS USED ON THIS MACHINE, IS GIVING VERY SATISFACTORY RESULTS."

This is the statement of the Consolidated Machine Tool Corporation, Rochester, N. Y., manufacturers of this massive Newton Milling Machine on which a Double PULLMORE Clutch is used for the Feed and Rapid Traverse.

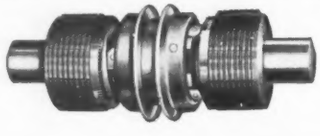
Here, as in the case of all high grade machinery which is called upon to give unfailing service, EFFICIENCY, COMPACTNESS and ADAPTABILITY are features necessary for a satisfactory clutch installation. They are the features of the PULLMORE which has led to its adoption as standard by leading manufacturers of:

Machine Tools
Welding Machines
Road Working Equipment
Cranes
Wire Spooling Machines
Book Binding Machinery
Pipe Threading Machines
Testing Machinery
Rubber Working Machinery
Printing Machinery
Fire Fighting Equipment
Industrial Trucks

IMPROVE YOUR MACHINE WITH THIS IMPROVED CLUTCH. Write for details now.



Both Single and Double type PULLMORE Industrial Clutches are illustrated here. Either type is furnished for operation in oil or dry, depending on requirements. Capacities range from 2 to 60 H. P. at 500 R. P. M.



Rockford Drilling Machine Co.

310 CATHERINE ST. · ROCKFORD, ILLINOIS

Sold by MORSE CHAIN CO., Ithaca, N. Y.
With offices in principal cities.

Made in ROCKFORD ILL. U.S.A.

SUNDSTRAND MACHINE TOOL CO. · ROCKFORD, ILLINOIS U.S.A.

ENGINEERED PRODUCTION

EXAMPLES FROM THE SUNDSTRAND FILES

No. 3410

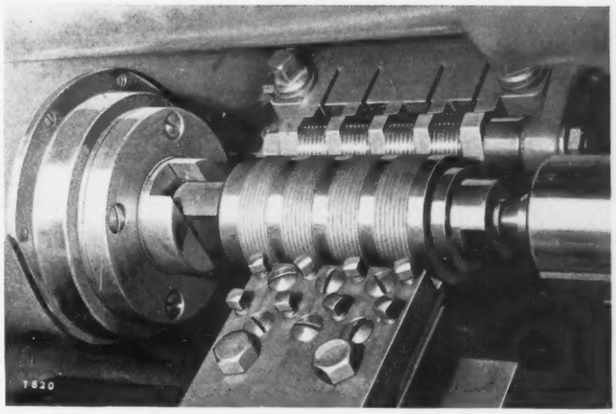
Lathes
Milling Machines
Tool Grinders
Centering Machines
Balancing Tools

They Wanted Lots of Accurate Turning They Bought a Battery of Stub Lathes

Early in 1934 our Engineered Production Department was asked to quote on turning and grooving equipment for accurate high production on piston rings. Result—an order for the three Stub Lathes shown in Fig. 1; together with tooling, shown close-up in Fig. 2. Twenty-four rings are mounted on an arbor in four groups of six each. Arbor is placed in Stub Lathe and cycle started. Tools feed to depth; feed to left, turn O. D. on the four groups of rings simultaneously at high speed and then retract slightly, motor slows to half-speed, rear tools groove all rings and retreat, feed releases. During this automatic cycle the operator is busy loading another arbor. When he returns the front carriage to starting position, the motor switch automatically re-sets to high speed. Production figures are confidential but they are high, and Stub Lathes can duplicate them on any similar work.

This is only one of a number of operations that Sundstrand Engineered Production has handled effectively for piston ring manufacturers. We have supplied a large amount of Sundstrand equipment for all of the standard turning and milling operations in piston ring production, and for many special operations.

We refer to these three Stub Lathes as a battery merely because they were all in one shipment. In the leading plants of the world there are many very large installations of Stub Lathes and Rigidmils. Some of these were delivered in one shipment, others developed as the result of repeat orders. Performance in every instance was satisfactory, and it often exceeded our estimates or the expectations of the purchasers. Sundstrand Engineered Production and Machine Tools pay the user well, and we are glad to cooperate in developing their uses to best advantage.



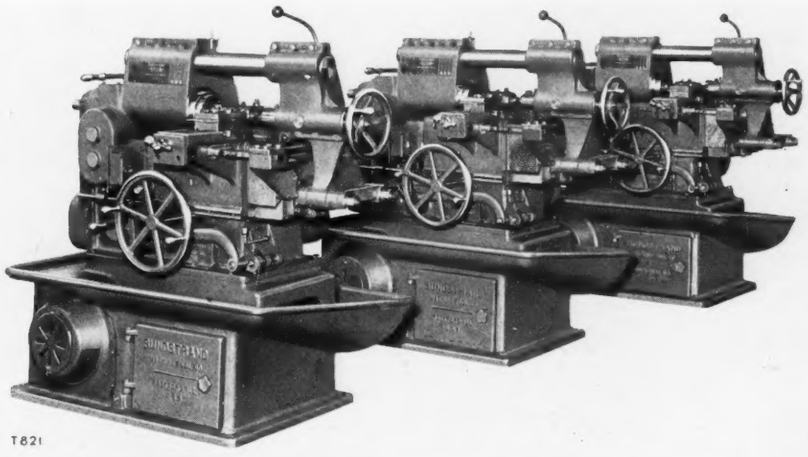
T820

Fig. 2. Close-up of piston-ring turning and grooving set-up.

Sundstrand Machine Tool Co.

Lathes · Milling Machines · Centering Machines · Balancing Tools

ROCKFORD ILLINOIS, U.S.A.



T821

Fig. 1. Three Stub Lathes equipped for piston-ring turning and grooving.

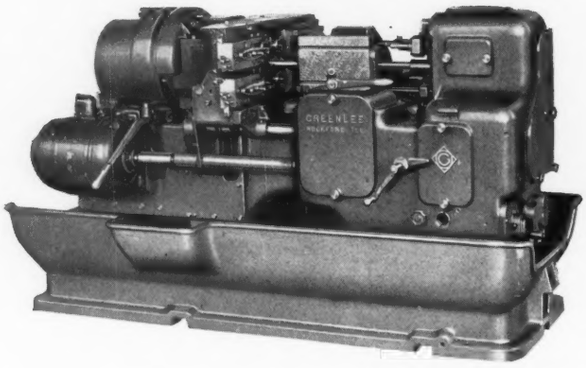
◆ ◆ ◆ ◆

NEW DIRECT-WIRE SERVICE

The Sundstrand offices are completely equipped with recently perfected devices for transmitting written as well as verbal messages by *direct wire* to and from all parts of the world. This new service provides greatest speed, convenience, and accuracy in communication; just as Sundstrand machine-tools provide the same qualities in production.

Made in ROCKFORD ILL. U.S.A.

Greenlee Four-Spindle Automatics Have Many Features for Improved Production . . . . . .



Ask for Your Copy Now!

This new descriptive bulletin will help you keep up on the developments in Four-Spindle Automatics. Its 16 pages not only illustrate many of the original Greenlee features, but they also explain their advantages and illustrate several set-ups where important savings were made as a result of them. You are invited to write for a copy. It will help you check up on the efficiency of your present equipment.

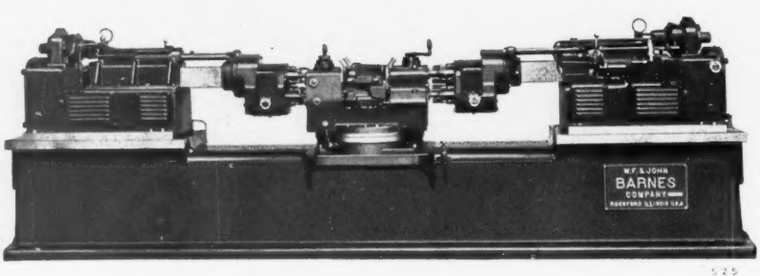
IMPROVED production with Greenlee Automatics is the result of various design features, which shorten the set-up time, reduce the idle cycle, and provide for faster machining and greater accuracy on many parts. These machines are built low and compact, and they are easy to get at. Set-up changes are simplified, because of their wide-open accessibility, and this, alone, means much in the way of improved production.

Multiple-Spindle Drilling and Tapping Machines

Greenlee BROS. & CO.
ROCKFORD, ILLINOIS, U.S.A.

Four-Spindle Automatics
Special Machinery

BARNES Square Ram *Hydraulic* Drill Units



Cut Cost of Reaming Operation

Shown above is a Barnes Duplex Machine in which two Square Ram Hydraulic Drill Units are used effectively to cut the cost of reaming transmission cases. This machine semi-finish and finish-reams in one handling of the work-pieces, and does it much faster and better than the method previously employed. The use of Barnes Hydraulic Drill Units simplifies construction, reduces first cost, and lowers operating and maintenance costs. Special attention is invited to the fact that the Square Rams, shown in extended position, provide ample support for the multiple spindle heads and maintain accurately their alignment with the work.

WRITE FOR CIRCULAR

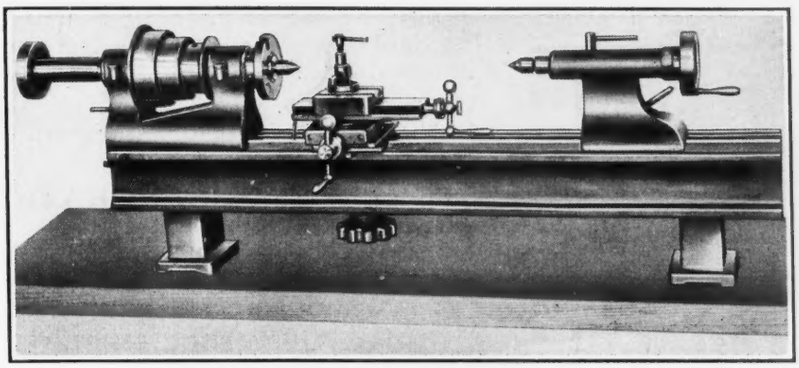
Barnes Square Ram Hydraulic Units have many features and advantages for cutting costs on drilling, boring, reaming, milling, and similar metal-working operations. These are described in a new circular that will be mailed postpaid on request. Write, today, for a copy of Circular H.U. 434.

ESTABLISHED 1872
W.F. & John BARNES Company
CONVERTIBLE HYDRAULIC MACHINE TOOLS
ROCKFORD, ILLINOIS, U.S.A.

ACCURATE, POWERFUL, ECONOMICAL BORING and DRILLING MACHINES

Made in ROCKFORD ILL. U.S.A.

Rivett Value at a "Low Price"



507 PRECISION BENCH LATHE

¾ IN. COLLET CAPACITY, 8 IN. SWING
20 IN. BETWEEN CENTERS—38 IN. BED

PRICES

Lathe with bronze headstock bearings	$160.00
or	
Lathe with ball bearing headstock	195.00
Collets—set of 12—1/16" to ¾" by 16ths	38.00
Compound slide rest with bolt	70.75
Countershaft, ball bearing	40.00
Lever chuck closer (plain bearing head)	28.00

BULLETIN 507-B AND COMPLETE PRICE LIST.

Rivett has attained its high machine tool standards in a "low priced" precision bench lathe through simplicity and standardization of design. The 507 is constructed to fulfill all the usual requirements of a plain bench lathe. A complete line of attachments is available.

Quality and serviceability have not been sacrificed in any particular—the rugged construction and accuracy of 507 have withstood eight years of severest test.

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LATHE AND GRINDER CORPORATION
BRIGHTON DISTRICT OF BOSTON, MASS

CONE 4-SPINDLE AUTOMATICS

are economical and accurate producers of screw machine parts up to 6" diameter, 7" milling length. They cut costs, increase production, boost profits. Write for particulars.

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ENGINE LATHES

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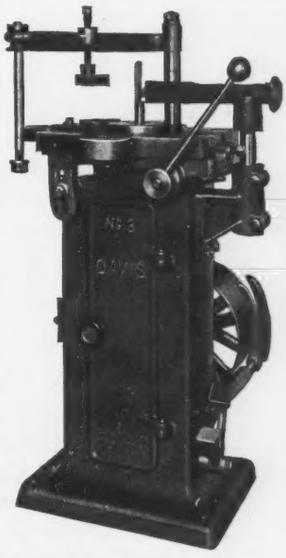
The Production Keyseater

Tilting Table—quick, convenient, *accurate* adjustments make it possible to keyseat taper bores as easily and quickly as straight bores and to handle all classes of keyseating with real production efficiency that makes for lower costs on both quantity and short run work.



The "broaching pull cut," the basic principle of the New Tilting Table as well as the standard model, insures a remarkably clean, fast, accurate cut in all classes of work.

Capacity—the New Davis Tilting Table Keyseater—3 sizes for keyways from 1/16" to 1½" in hubs to 14" (longer with special equipment).

Send for details of this New Davis and of the Standard Fixed Table Model.

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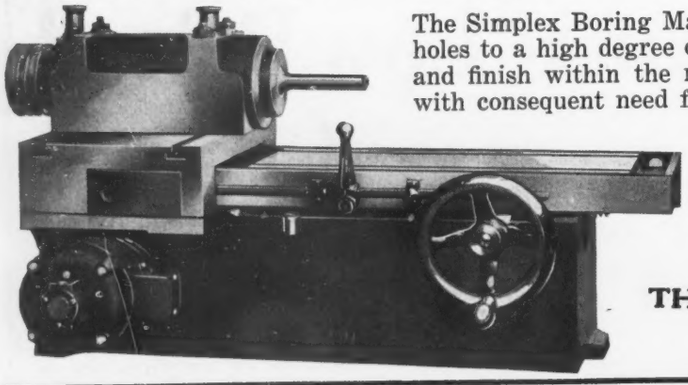

The Simplex Boring Machine brings the best practice in finishing holes to a high degree of accuracy in size, roundness, straightness and finish within the means of every shop. Light tool pressure, with consequent need for only light clamping pressure eliminates distortion, deflection and chatter—a new standard of workmanship at no increase in operating costs.

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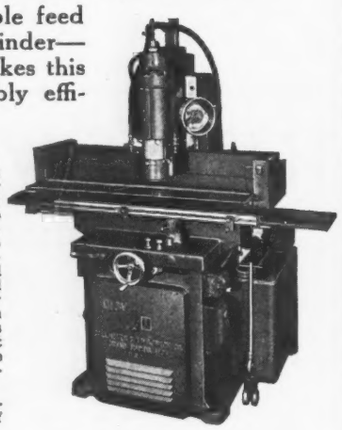
No. 3 V
HYDRAULIC FEED VERTICAL SPINDLE SURFACE GRINDER

Featuring hydraulic table feed on a vertical surface grinder—modern design that makes this new machine remarkably efficient.



Important details:

NOTE THESE FEATURES: Table speeds from as slow as 2' per minute to over 100' per minute; automatic down feed variable from .0001" to .002" per stroke. Drive through a 5 H.P., 60 cycle motor with ample overload capacity mounted directly on the wheel spindle eliminates belts; head with motor and spindle assembly is rigid, heavy — vibration with consequent wear on the wheel is practically eliminated. Convenient operation, provision for ample flow of coolant, "one shot" lubrication.

See the Catalog for complete details of the 3 V and the rest of NEW-MODERN G-L Line.

GALLMEYER & LIVINGSTON CO.
350 Straight Ave., S.W. GRAND RAPIDS, MICH.
Builders of Surface, Universal Cutter and Tool, Drill and Tap Grinders

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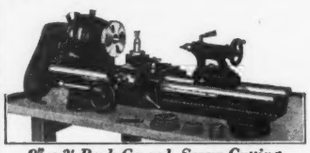

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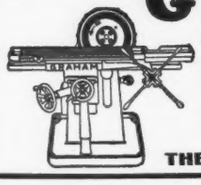

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GRINDER CHUCKS hold Abrasive Rings, 10" to 30" diameter. *Send for Circulars.*

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Specialists in Tool and Cutter Grinding Equipment

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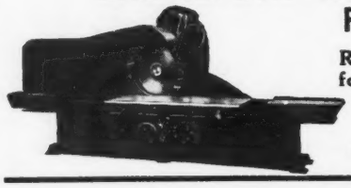

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HORIZONTAL and VERTICAL for TOOLROOM and PRODUCTION

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FOR SPEED—ACCURACY—FINISH

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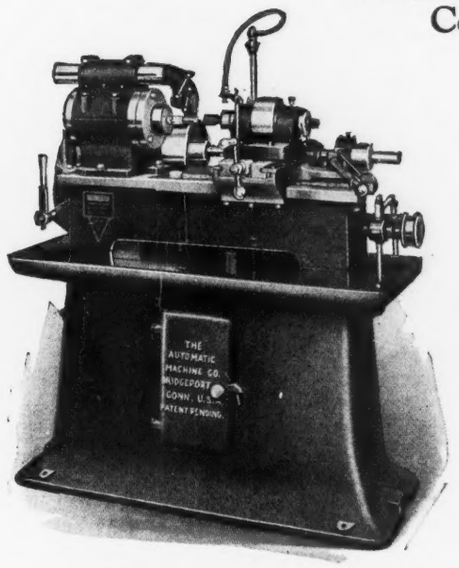

Showing machine with overhanging arm center.

For the cutting of threads—Internal or External—Straight or Taper and Close to Shoulder on

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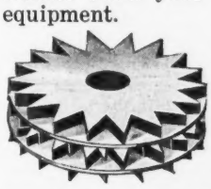
Use our 25 years of specialized experience to get top results from your grinding wheel dresser and cutter equipment.



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CALDER CORRECT EMERY WHEEL DRESSERS

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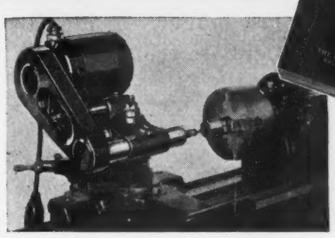
Precision Grinding in Theory and in Fact!



THE NO. 4 DUMORE GRINDER

illustrated above is of a size and type especially adapted for use on small lathes . . . It is only one of eight models, ranging in size from 1/40 to 3/4 H.P. . . The booklet illustrated is a practical treatise on the subject "Precision Grinding". Write for your copy of this excellent booklet and also our new Electrical Tool Catalog.

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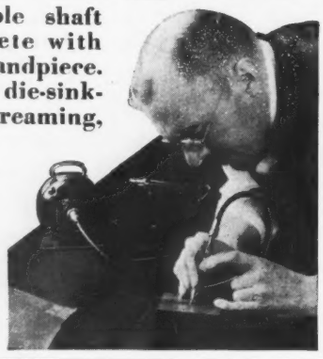

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Made of the finest materials and to an unusual degree of accuracy, these tools cut fast and clean. They save time and do better work. Economical too, because better materials and better construction make them last longer. A wide variety of sizes and shapes to choose from.

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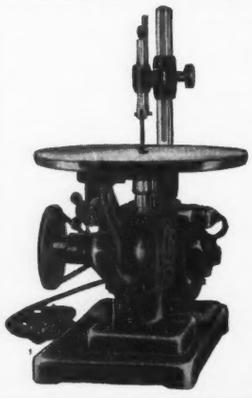
Makers of Small Thread Millers, Gear Cutters and other Small Automatic Machines

ILLINOIS DIE FILING MACHINE



A compact, reliable, smoothly operating machine for filing, stoning or sawing.

Furnished with or without overarm.

Size 12″ by 18″. Table 12″ diameter 12″ high. Spindle stroke 1″. Height with overarm 21¾″.

Furnished regularly with ⅙ H.P.A.C. motor with round belt. It can be furnished for flat belt drive when necessary.

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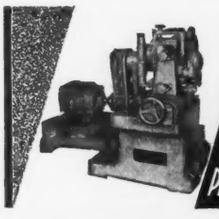

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Centerless feed machines for cylindrical work, Conveyor feed for flat work and Hand operated for misc. Great producers and labor savers.

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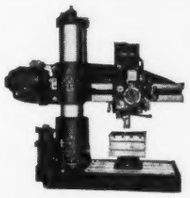

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The outstanding ability of Carlton Radial Drills on every type of manufacturing and tool room work is directly traceable to these six features:

Equipped with ball bearings throughout.
Constructed on unit principle.
All steel gears, running in oil.
Concentrated, convenient control.
Quiet running at all speeds.
Low hung drive to spindle.

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Multiple Spindle Drillers, Borers, Counterborers, Reamers, Lappers, Tappers, and Universal Joint Machines

Particularly Designed for High Production Work

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Drilling and Tapping Machines
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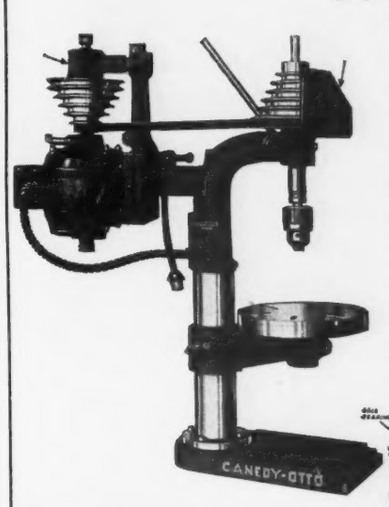
"Precision Built"

CANEDY-OTTO
DRILLING UNITS

C-O No. 33 Ball Bearing Six Speed Sensitive Bench Drill

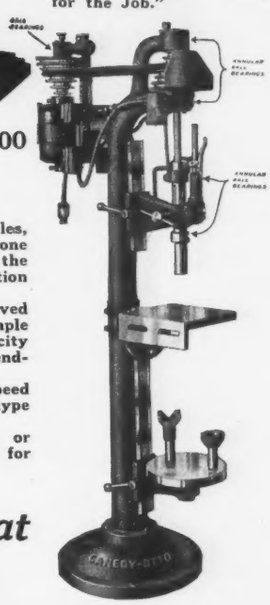


Two annular ball bearings in the spindle cone pulley — ball bearing motor bracket and one ball thrust bearing on spindle which has a 3" travel. Six step sheave type pulleys give wide range of spindle speeds, heavy endless V Belt drive transmits ample power to drive to full capacity of ½".

Belt tension easily regulated—speed changes easily made by original C-O simplified method.

Furnished completely equipped even to three wire, covered cord and three-way plug— "Ready for the Job."

The C-O Six Speed No. 3000 F-V Sliding Head Sensitive Drill



Annular ball bearings in the spindles, two ball bearings on the spindle cone pulley, self aligning ball bearing on the motor bracket insure real anti-friction operation with minimum wear.

Wide range of spindle speeds achieved by six-step sheave type pulleys—ample power to drive the drill to full capacity of ⅝" is obtained through heavy endless V-Belt drive.

New C-O method of making speed changes; extra sensitive ratchet type lever feed.

Furnished in any voltage cycles or phase—completely equipped, "Ready for the Job."

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Modern drills built to meet the most exacting demands of modern production—priced to fit today's budget.

Canedy-Otto Sensitive Drilling Machines are real precision units that stand comparisons based on results with any machines of this type. "Sensible" prices are achieved by correct simplified design and efficient production methods.

Send for details of the C-O Line of Precision Built Drilling Units—"Ready for the Job."

CANEDY-OTTO MFG. CO.
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STOP those AIR LOSSES

Replacing one leaky air valve with an AIR-SAVER will pay for the installation, and show a real profit the first year.

AIR-SAVERS deliver leak-proof service continually. They eliminate costly shut-downs for valve maintenance.

Stainless steel and brass construction makes AIR-SAVERS free from rust and corrosion—absolutely dependable.

Easily installed with simple fittings furnished. Write for data — use coupon.

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Send data on your AIR-SAVER.

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It operates as follows: As soon as the coil is placed on the Reel the motor starts up automatically, accumulating loose loops which depress a "finger," stopping the motor. As soon as the loose loops of stock are used up by the Roll Feed or by hand feeding, the "finger" rises and again starts the motor; and when the necessary loose loops of stock have accumulated the motor is stopped automatically. *For circular and prices please write.*

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WIRE FORMING MACHINES,
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MULTIPLE SPINDLE LATHES—
For Chucked and Centered Work.

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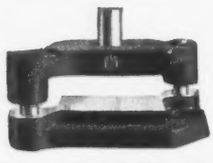

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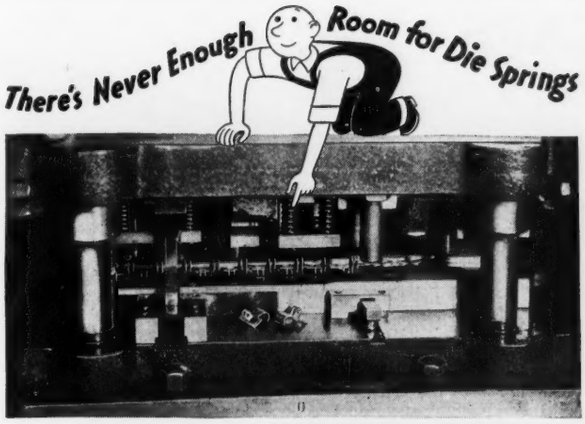

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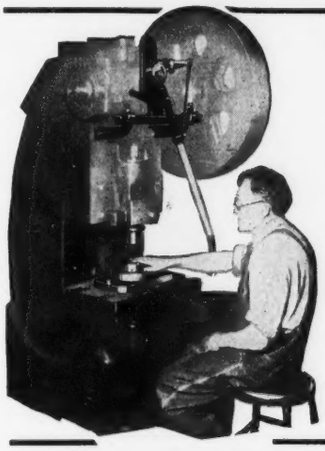

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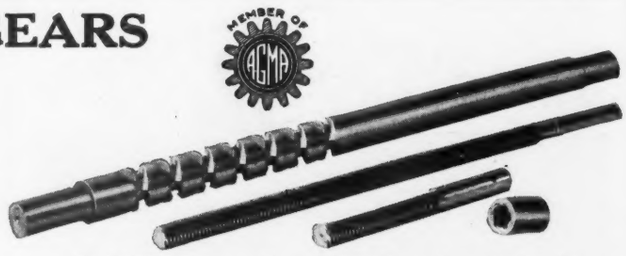

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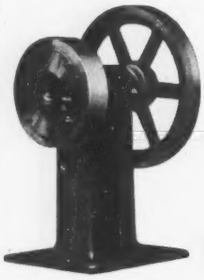

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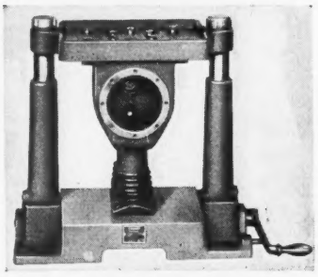

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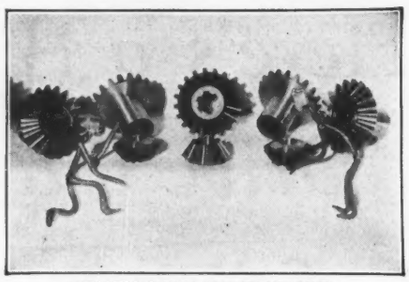

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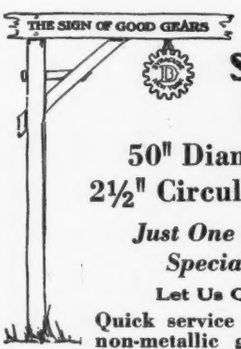

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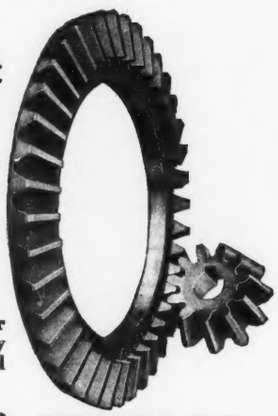

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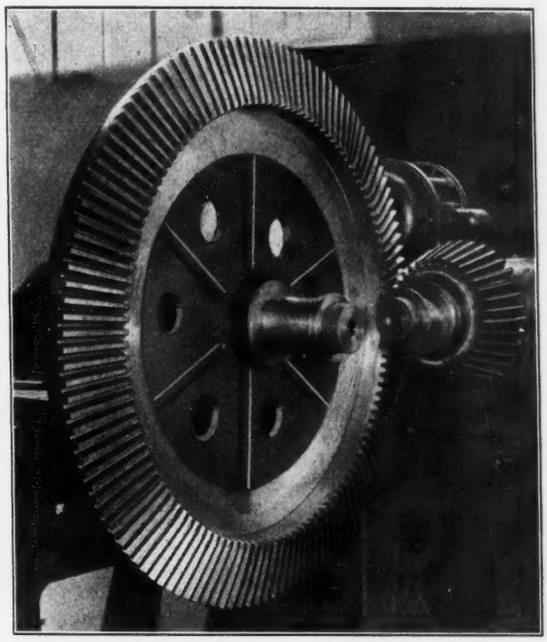

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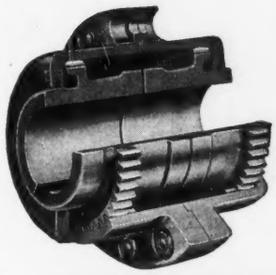

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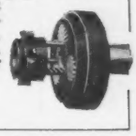

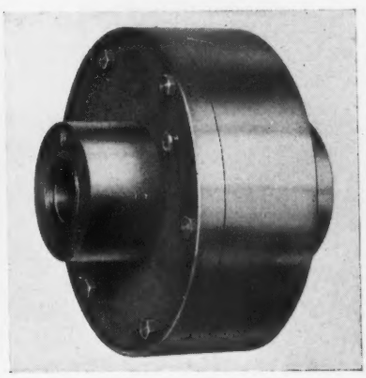

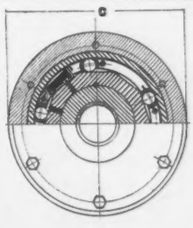

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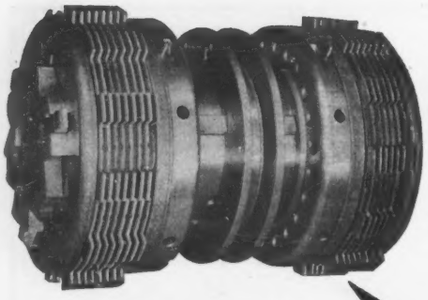

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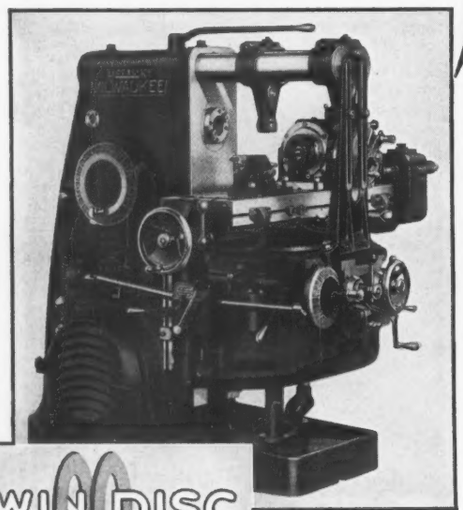

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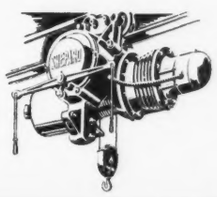

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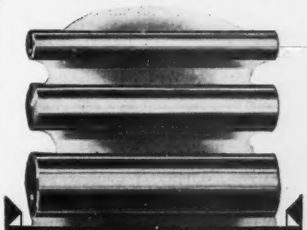

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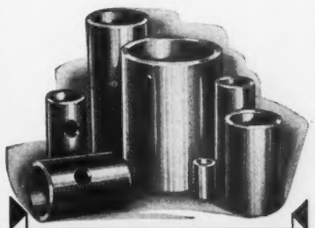

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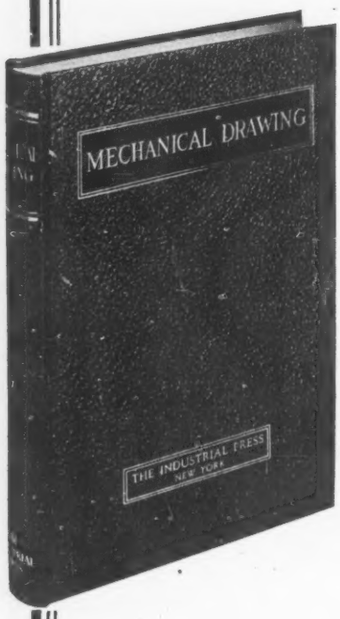

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No. 2B, 2BS, 3B Milwaukee Plain
No. 2½B Milwaukee Vertical
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No. 2, 3 Wilmarth & Morman Auto. Surface
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4' American Sensitive, inclosed head, D.C. drive
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D2, D3, D4 Colburn H.D. Upright
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1, 2, 4, 6 spindle Allen H.S.
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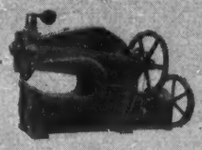

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Carborundum Co., Niagara Falls, N. Y.

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See Hoists, Air.

AIR TOOLS
See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

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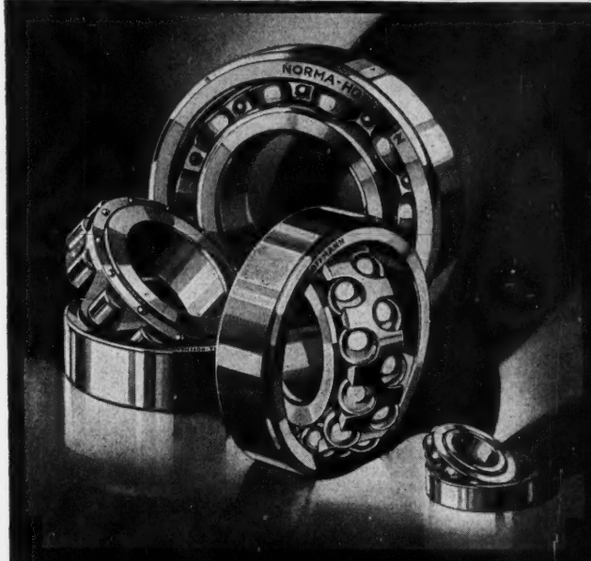

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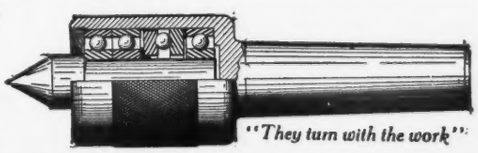

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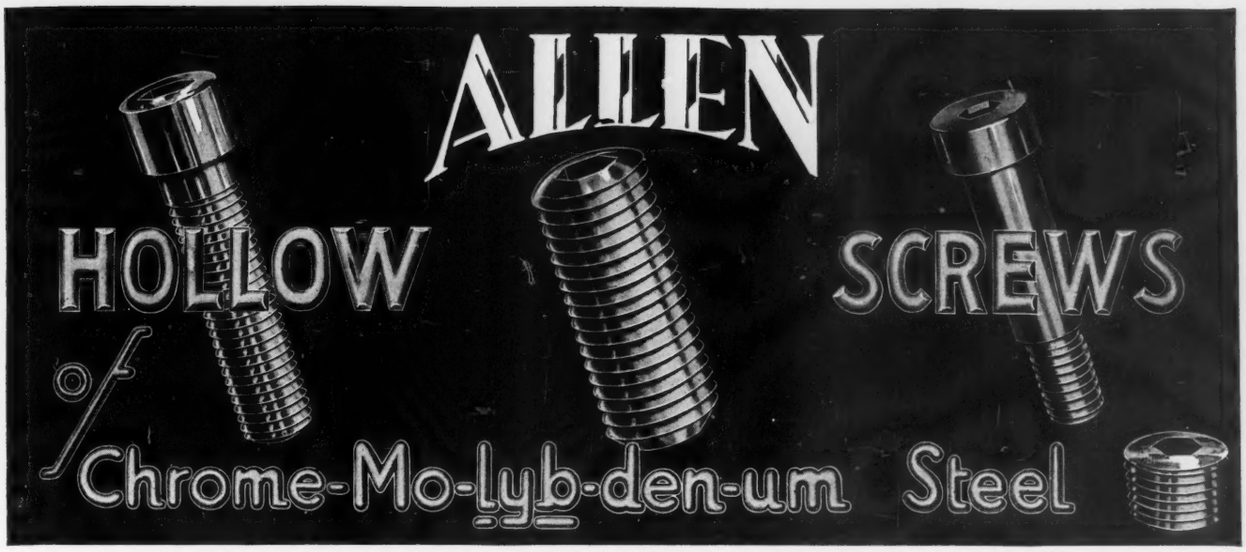

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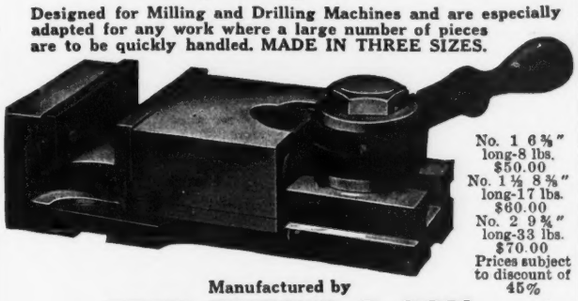

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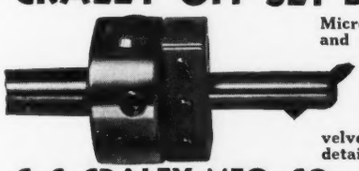

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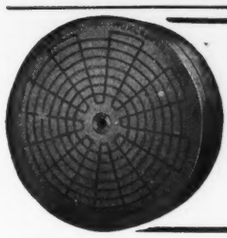

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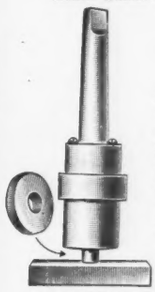

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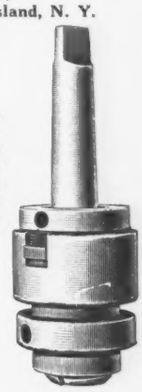

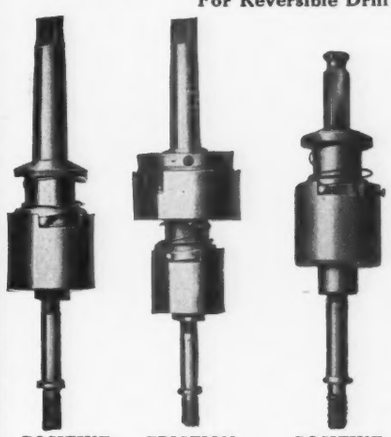

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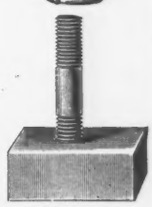

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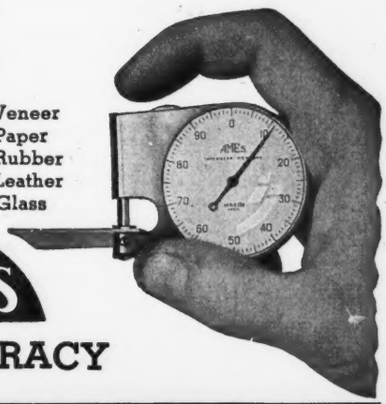

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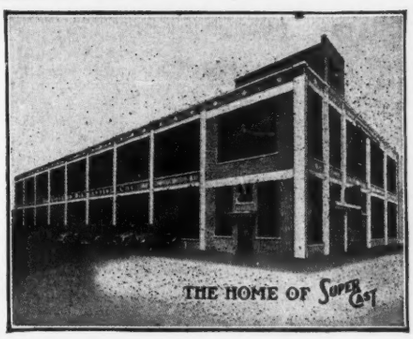

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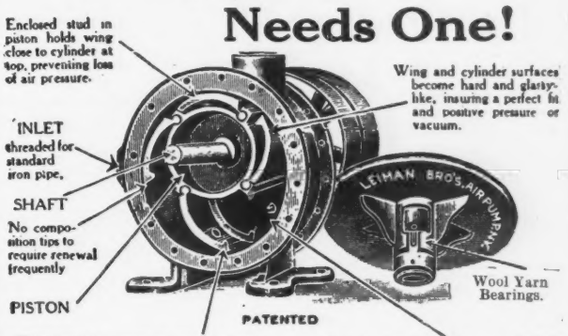
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LATHES, AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Rockford Machine Tool Co., 2412 Kishwaukee Road, Rockford, Ill.

LATHES, AXLES AND SHAFT
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.

LATHES, BENCH
Ames, B. C., Co., Waltham, Mass.
Diamond Machine Co., Providence, R. I.
Rivett Lathe & Grinder Corp., Brighton, Boston, Mass.
South Bend Lathe Works, Inc., South Bend, Ind.

LATHES, BORING
Gisholt Machine Co., Madison, Wis.

LATHES, BRASS WORKERS'
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.

LATHES, CRANKSHAFT
Lodge & Shipley Machine Tool Co., Cincinnati, O.

LATHES, DOUBLE-END
Greenlee Bros. & Co., Rockford, Ill.
Sundstrand Mch. Tool Co., Rockford, Ill.

LATHES, ENGINE
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Gisholt Machine Co., Madison, Wis.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.
South Bend Lathe Works, Inc., South Bend, Ind.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
Sundstrand Mch. Tool Co., Rockford, Ill.

LATHES, EXTENSION BED AND GAP
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
South Bend Lathe Works, Inc., South Bend, Ind.

LATHES, GUN BORING
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.

LATHES, SPEED
Diamond Machine Co., Providence, R. I.

LATHES, SPINNING
See also Chucking Machines.

LATHES, TURRET
Brown & Sharpe Mfg. Co., Providence.
Bullard Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
Rivett Lathe & Grinder Corp., Brighton, Boston, Mass.
South Bend Lathe Works, Inc., South Bend, Ind.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.

LEVELS
Universal Boring Machine Co., Hudson, Mass.

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Houghton, E. F. & Co., Philadelphia.
Pyroil Co., LaCrosse, Wis.
Sun Oil Co., Philadelphia.

LUBRICATING SYSTEMS
Greene, Tweed & Co., 109 Duane St., New York City.
Madison-Kipp Corp., Madison, Wis.
Rivett Lathe & Grinder Corp., Brighton, Boston, Mass.

MACHINISTS' SMALL TOOLS
See Calipers, Hammers, Wrenches, Drills, Taps, etc.

MANDRELS, EXPANDING AND SOLID
See Arbors and Mandrels, Expanding and Solid.

MARKING MACHINES
V & O Press Co., Hudson, N. Y.

MATRIX METAL
Cerro de Pasco Copper Corp., 44 Wall St., New York.

MEASURING MACHINES, PRECISION
Federal Products Corp., Providence.
Hanson-Whitney Mch. Co., Hartford, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.

METAL PATTERN ALLOYS
Cerro de Pasco Copper Corp., 44 Wall St., New York.

METALS, BEARING
See Bearing Bronze, Babbitt, etc., and Bushings, Brass, Bronze, etc.

METERS (See Recording Instruments)

MICROMETERS
Brown & Sharpe Mfg. Co., Providence.

MILLING AND DRILLING MACHINES, UPRIGHT
See Drilling and Milling Machines, Vertical.

MILLING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.
Rivett Lathe & Grinder Corp., Brighton, Boston, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Potter & Johnston Mch. Co., Pawtucket, R. I.

MILLING MACHINES, BENCH
Ames, B. C., Co., Waltham, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.

MILLING MACHINES, CIRCULAR CONTINUOUS
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.

MILLING MACHINES, DUPLEX
Brown & Sharpe Mfg. Co., Providence.

MILLING MACHINES, HAND
Sundstrand Mch. Tool Co., Rockford, Ill.

MILLING MACHINES, HORIZONTAL, PLAIN AND UNIVERSAL
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Sundstrand Mch. Tool Co., Rockford, Ill.

MILLING MACHINES, LINCOLN TYPE
Brown & Sharpe Mfg. Co., Providence.

MILLING MACHINES, MULTIPLE SPINDLE
Automatic Machine Co., Bridgeport, Ct.

MILLING MACHINES, PLANETARY
Hall Planetary Co., Philadelphia.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Sundstrand Mch. Tool Co., Rockford, Ill.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Preis Engraving Machine Co., 157 Summit St., Newark, N. J.

MILLING TOOLS, HOLLOW ADJUSTABLE
Geometric Tool Co., New Haven, Conn.

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See Special Machinery and Tools.

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Dumore Company, Racine, Wis.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland.

NIBBLING MACHINES
Schatz Mfg. Co., Poughkeepsie, N. Y.

NICKEL
International Nickel Co., 67 Wall St., New York City.

NIPPLE THREADING MACHINERY
Landis Mch. Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Nut Machinery.

ODOMETERS
Veeder-Root, Inc., Hartford, Conn.

OIL CUPS
Boston Gear Works, Inc., North Quincy, Mass.
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago.

OIL GROOVERS
Hanson-Whitney Mch. Co., Hartford, Conn.

OIL HOLE COVERS
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago.

OILERS
Madison-Kipp Corp., Madison, Wis.

OILS, LUBRICATING
Houghton, E. F., & Co., Philadelphia.
Pyroil Co., LaCrosse, Wis.
Sun Oil Co., Philadelphia.

OILS, QUENCHING AND TEMPERING
Sun Oil Co., Philadelphia.

OILS, SOLUBLE
See Compound, Cutting, Grinding, etc.

OXYGEN
Linde Air Products Co., 30 E. 42nd St., New York.

PARALLELS
Walker, O. S. Co., Inc., Worcester, Mass.

PATTERN SHOP MACHINERY
Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.

PATTERNS, METAL
Mummert-Dixon Co., Hanover, Pa.
V & O Press Co., Hudson, N. Y.

PATTERNS, WOOD
V & O Press Co., Hudson, N. Y.

PHOSPHOR BRONZE
See Bronze.

PIPE BENDING ALLOYS
Cerro de Pasco Copper Corp., 44 Wall St., New York.

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Foote-Burt Co., Cleveland, O.
Fox Machine Co., Jackson, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.

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Republic Steel Co., Youngstown, O.

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Jones & Laughlin Steel Corp., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.

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Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Rockford Machine Tool Co., 2412 Kishwaukee Road, Rockford, Ill.

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Schatz Mfg. Co., Poughkeepsie, N. Y.

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Jones & Laughlin Steel Corp., Pittsburgh, Pa.

PLATES, SURFACE
Brown & Sharpe Mfg. Co., Providence.

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Diamond Machine Co., Providence, R. I.
Hammond Machinery Builders, Inc., 1604 Douglas Ave., Kalamazoo, Mich.
Production Mch. Co., Greenfield, Mass.

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Barnes, W. F. & John Co., Rockford, Ill.
Canedy-Otto Mfg. Co., Chicago Heights, Ill.

PRESSES, BROACHING
Fox Machine Co., Jackson, Mich.
Lapointe Machine Tool Co., Hudson, Mass.
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PRESSES, FOOT
Baird Machine Co., Bridgeport, Conn.
Niagara Machine & Tool Wks., Buffalo.
V & O Press Co., Hudson, N. Y.

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Morgan Engineering Co., Alliance, O.
Niagara Machine & Tool Wks., Buffalo.
Schatz Mfg. Co., Poughkeepsie, N. Y.
V & O Press Co., Hudson, N. Y.

PRESSES, HYDRAULIC
Fox Machine Co., Jackson, Mich.
Lapointe Machine Tool Co., Hudson, Mass.
Morgan Engineering Co., Alliance, O.

PRESSES, SCREW
Barnes, W. F. & John Co., Rockford, Ill.
Niagara Machine & Tool Wks., Buffalo.
Schatz Mfg. Co., Poughkeepsie, N. Y.

PRESSES, SHEET METAL WORKING
Automatic Machine Co., Bridgeport, Ct.
Baird Machine Co., Bridgeport, Conn.
Niagara Machine & Tool Wks., Buffalo.
Schatz Mfg. Co., Poughkeepsie, N. Y.
V & O Press Co., Hudson, N. Y.

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Canedy-Otto Mfg. Co., Chicago Heights, Ill.
Fox Machine Co., Jackson, Mich.
Morgan Engineering Co., Alliance, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.

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Automatic Machine Co., Bridgeport, Ct.
Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Leland-Gifford Co., Worcester, Mass.

PULLEYS
Boston Gear Works, Inc., North Quincy, Mass.

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Hammond Machinery Builders, Inc., 1604 Douglas Ave., Kalamazoo, Mich.

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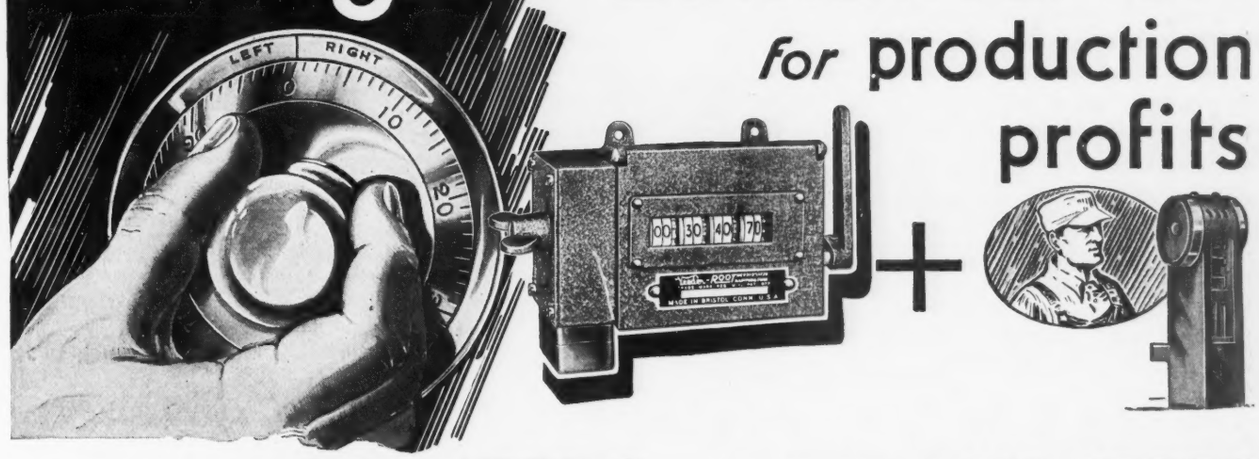

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Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.
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Niagara Machine & Tool Works., Buffalo.
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Leeds & Northrup Co Philadelphia
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Boston Gear Works, Inc., North Quincy, Mass.
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Mchy. Co., Hartford, Conn.
Massachusetts Gear & Tool Co., 34 Nashua St., Woburn, Mass
Meisel Press Mfg. Co., 948 Dorchester Ave., Boston 25, Mass.
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Carboloy Co., Inc., 2487 E. Grand Blvd., Detroit, Mich.
Card, S. W., Mfg. Co., Mansfield, Mass.
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Columbus Die Tool & Machine Co., Columbus, O.
Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.
Gammons-Holman Co., Manchester, Ct.
Greenfield Tap & Die Corp., Greenfield, Mass
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Michigan Tool Co., Detroit, Mich.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

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Barber-Colman Co., Rockford, Ill.
Cleveland Twist Drill Co., Cleveland, O
Davis Boring Tool Co., Inc., 6200 Maple Ave., St Louis, Mo
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

REAMERS, TAPER PIN HOLE
Gammons-Holman Co., Manchester, Ct.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.

REAMING MACHINES
Blanchard Machine Co., 64 State St., Cambridge, Mass.

RECORDING INSTRUMENTS FOR ELECTRICITY
Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philade'phia

RECORDING INSTRUMENTS FOR PRESSURE
Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philade'phia.

RECORDING INSTRUMENTS FOR SPEED
Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philade'phia.

RECORDING INSTRUMENTS FOR TEMPERATURE
Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philadelphia.

RECORDING INSTRUMENTS FOR TIME
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.

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Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philade'phia.

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RHEOSTATS
General Electric Co., Schenectady, N. Y.

RIVETERS, HYDRAULIC
Morgan Engineering Co., Alliance, O.

RIVETERS, PNEUMATIC
Grant Mfg. & Mch. Co., N.W. Station, Bridgeport, Conn.

RIVETING MACHINES
Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.
High Speed Hammer Co., Inc., Rochester, N. Y.

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Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.

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Brown & Sharpe Mfg. Co., Providence.

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Oakite Products, Inc., 26 Thames St., New York City.

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Wiesman Mfg. Co., Dayton, O.

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SANDERS
Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.

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Atkins, E. C., & Co., Inc., Indianapolis, Ind.

SAW BLADES, HACK
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.

SAW BLADES, METAL CUTTING BAND
Atkins, E. C., & Co., Inc., Indianapolis, Ind.

SAW FRAMES, HACK
Atkins, E. C., & Co., Inc., Indianapolis, Ind.

SAW GUARDS, CIRCULAR
Atkins, E. C., & Co., Inc., Indianapolis, Ind.

SAW TABLES
Baker Brothers, Inc., Toledo, O.

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Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.

SAWING MACHINES, FRICTION
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.

SAWING MACHINES, METAL CUTTING BAND
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.

SAWING MACHINES, POWER HACK
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.
Atkins, E. C., & Co., Inc., Indianapolis, Ind.

SAWING MACHINES, WOOD
Barnes, W. F. & John Co., Rockford, Ill.

SAWS, CIRCULAR METAL CUTTING
Union Twist Drill Co., Athol, Mass.

SAWS, HOLE
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.

SAWS, METAL CUTTING HAND
Atkins, E. C., & Co., Inc., Indianapolis, Ind.

SAWS, SCREW SLOTTING
Atkins, E. C., & Co., Inc., Indianapolis, Ind.
Barber-Colman Co., Rockford, Ill.
Union Twist Drill Co., Athol, Mass.

SCREW CUTTING TOOLS
See Taps and Dies.

SCREW DRIVING AND NUT SETTING EQUIPMENT
Apex Machine & Tool Co., Dayton, O.
Errington Mechanical Laboratory, 200 Broadway, New York.
Haskins, R. G., Co., 4634 Fulton St., Chicago, Ill.

SCREW MACHINES, AUTOMATIC SINGLE AND MULTIPLE SPINDLE
Brown & Sharpe Mfg. Co., Providence.
Cone Auto. Mch. Co., Inc., Windsor, Vt.
Greenlee Bros. & Co., Rockford, Ill.

SCREW MACHINES, HAND
See also Lathes, Turret.
Brown & Sharpe Mfg. Co., Providence.
Jones & Lamson Machine Co., Springfield, Vt.
Potter & Johnston Machine Co., Pawtucket, R. I.
Rivett Lathe & Grinder Corp., Brighton, Boston, Mass.

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Brown & Sharpe Mfg. Co., Providence.
Greenlee Bros. & Co., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.
Potter & Johnston Mch. Co., Pawtucket, R. I.

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Meisel Press Mfg. Co., 948 Dorchester Ave., Boston 25, Mass.
Standard Pressed Steel Co., Jenkintown, Pa.

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Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.

SCREWS, CAP, SET, SAFETY SET AND MACHINERY
Allen Mfg. Co., 125 Shelton St., Hartford, Conn.
Bristol Co., Waterbury, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

SEAMLESS STEEL TUBING
See Tubing, Seamless Steel.

SECOND-HAND MACHINERY, ETC.
Cincinnati Machinery & Supply Co., Cincinnati.
Eastern Machinery Co., Cincinnati.
Emerman, Louis E. & Co., 1761 Elston Ave., Chicago.
Miles Machinery Co., Saginaw, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.

SHAFTING, STEEL
Cumberland Steel Company, Cumberland, Md.
Jones & Laughlin Steel Corp., Pittsburgh
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Standard Pressed Steel Co., Jenkintown, Pa.
Union Twist Drill Co., Athol, Mass.

SHAFTING, STEEL TUBING FOR
National Tube Co., Pittsburgh, Pa.

SHAFTS, TURNED AND GROUND
Cumberland Steel Company, Cumberland, Md.

SHAPERS
Automatic Machine Co., Bridgeport, Ct.
Potter & Johnston Machine Co., Pawtucket, R. I.
Rockford Machine Tool Co., 2412 Kishwaukee Road, Rockford, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.

SHAPERS, VERTICAL
Hanson-Whitney Mch. Co., Hartford, Conn.

SHAPES, STRUCTURAL
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Pittsburgh

SHEARING MACHINERY
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Morgan Engineering Co., Alliance, O.
Niagara Mch. & Tool Wks., Buffalo.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEARS, ROTARY
Niagara Mch. & Tool Wks., Buffalo.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Union Twist Drill Co., Athol, Mass.

SHEARS, SQUARING
Niagara Mch. & Tool Wks., Buffalo.
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHERARDIZING, ELECTRIC
General Electric Co., Schenectady, N. Y.

SHEET METALS
American Sheet & Tin Plate Co., Pittsburgh, Pa.
New Jersey Zinc Co., 160 Front St., New York City.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.

SHEETS, IRON AND STEEL
Republic Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago, Ill.

SLEEVES
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES
Baker Brothers, Inc., Toledo, O.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.

SOCKETS
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 75 Spring St., New York City.

SPACING AND BORING EQUIPMENT
Craley, C. C., Mfg. Co., Shillington, Pa.

SPECIAL MACHINERY AND TOOLS
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Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Columbus Die, Tool & Machine Co., Columbus, O.
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Earle Gear & Mch. Co., 4709 Stenton Ave., Philadelphia.
Gisholt Machine Co., Madison, Wis.
Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hartford Special Mchy. Co., Hartford, Conn.
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Littell, F. J., Mch. Co., 4125 Ravenswood Ave., Chicago.
Manufacturers' Consulting Engineers, Syracuse, N. Y.
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Modern Machine Corp., 285 N. 6th St., Brooklyn, N. Y.
Morgan Engineering Co., Alliance, O.
Niagara Mch. & Tool Wks., Buffalo.
Rockford Machine Tool Co., 2412 Kishwaukee Road, Rockford, Ill.
Ruthman Machinery Co., 530 E. Front St., Cincinnati, O.
Union Twist Drill Co., Athol, Mass.
V & O Press Co., Hudson, N. Y.
Waltham Mch. Wks., Waltham, Mass.

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Boston Gear Works, Inc., North Quincy, Mass.
Cullman Wheel Co., 1339 Altgeld St., Chicago.
Grant Gear Works, Inc., Boston, Mass.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.
Shepard Niles Crane & Hoist Corp., 444 Schuyler Ave., Montour Falls, N. Y.

SPINNING LATHES
See Lathes, Spinning.

SPRING COILING AND FORMING MACHINERY
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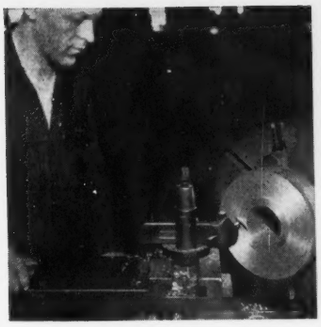

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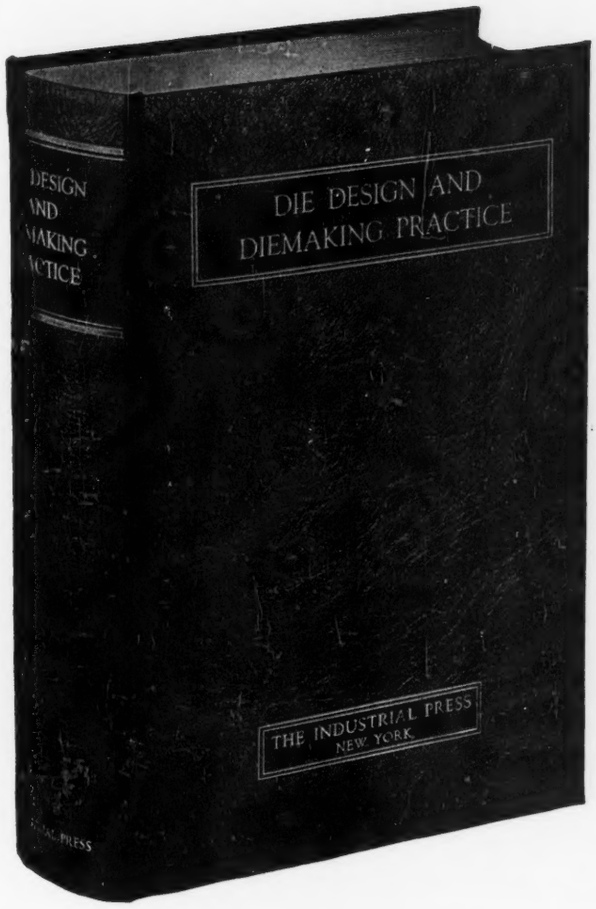

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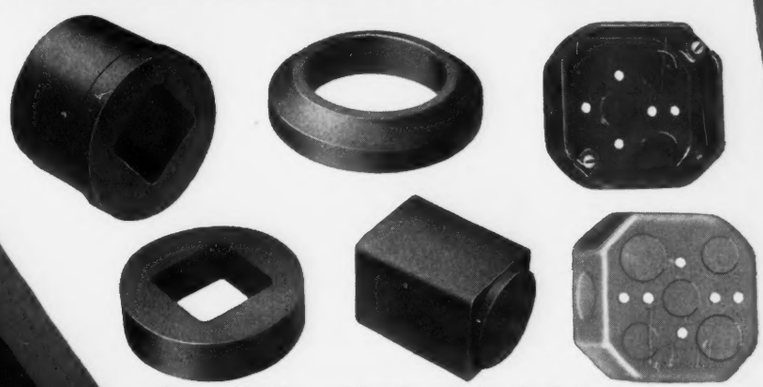
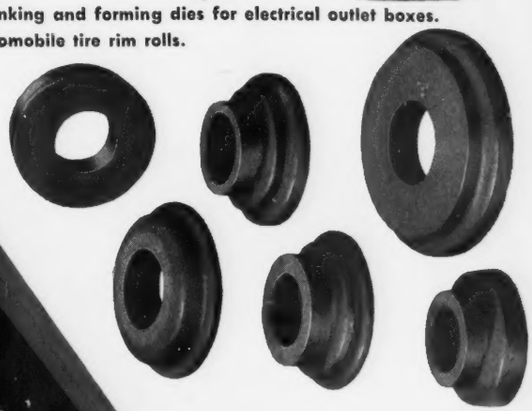
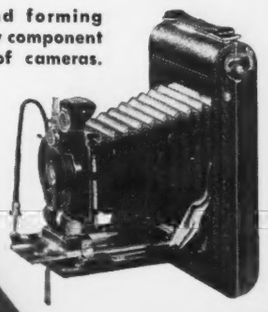
OUTLET BOXES, TIRE RIMS AND CAMERAS



Above: Blanking and forming dies for electrical outlet boxes.
Below: Automobile tire rim rolls.



Blanking and forming dies for many component small parts of cameras.



COULD any products be further removed—one from the other—than outlet boxes, tire rims, and cameras! Yet these examples are typical of the many and diversified types of industry which we serve with our tool steels, cast to shape. We do not overstate when we say that whatever the industry and tool steel need, one of our steels will meet the most exacting requirements better and more economically.

Our complete line includes Krokoloy, Martin Steel, and Castaloy, all three alloy tool steels, cast to the most intricate shapes with a minimum of material, and hardened in still air—and Carbomang, an oil hardening tool steel, cast to shape, for purposes where alloy steel castings are not required.

In addition to our steels we furnish without obligation engineering co-operation on your die castings and machine tool problems. Write for our set of literature.

KROKOLOY

MARTIN STEEL

CASTALOY

CARBOMANG

DETROIT ALLOY STEEL COMPANY

Foot of Iron Street — Detroit, Michigan

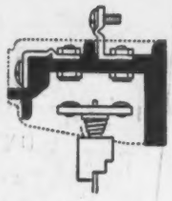
Eastern District Sales Manager: T. Andersen
135 Post Ave., Lyndhurst, New Jersey

Central District Sales Manager: William C. Eakin
707 Berkshire Ave., Pittsburgh, Pennsylvania

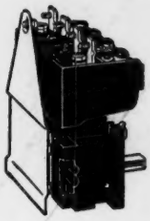
A. C. ACROSS-THE-LINE STARTERS

3 H. P., 110 V.—5 H. P., 220 V.—7½ H. P., 440/550 V.

MANUAL 609



AUTOMATIC 709



BOTH ARE PUSH BUTTON OPERATED

Whether you need an automatic starter or can use a manual starter, in these two leaders of the Allen-Bradley line you obtain the ultimate in performance and reliability for motor control in each class of service.

Both are push button operated! Outwardly, they resemble each other—inwardly, the protection which they afford man, motor, and machine marks their difference.

The Bulletin 609 Manual Starter is used on fans and other motor-driven units which require only overload protection and are not started and stopped frequently. They are used where restarting after shutdown, due to line failure, would not endanger operator or machine.

The Bulletin 709 Automatic Starter has a much broader field—it should be used on all machine tools and other equipment which require more safety features than only overload protection for the motor. The Bulletin 709 Automatic Starter protects man, motor, and machine—in addition to protection for the motor, it provides no-voltage release protection for man and machine. Both of these manual and automatic starters are available in a wide variety of enclosing cabinets that meet every service condition. For complete details, send for Bulletins 609 and 709.

ALLEN-BRADLEY CO.
1331 S. First Street Milwaukee, Wis.

ALLEN-BRADLEY

BULLETIN 609 MANUAL
A.C. Across - The - Line Starter, Type A, in pressed steel cabinet. Two reliable overload relays, which require no replacements, are reset from front of cabinet.

BULLETIN 609 MANUAL
A.C. Across - the - Line Starter, in Type B, watertight, cadmium plated enclosure. Ideal for machines in dairies, bottling plants, breweries, etc.

BULLETIN 609 MANUAL
A.C. Across - the - Line Starter, in Type G, explosion-proof enclosure, for use in explosive atmospheres, gases, and other dangerous installations.

BULLETIN 609 MANUAL
A.C. Across - the - Line Starter, in Type A, pressed steel cabinet, provided with pedestal mounting. Dual mountings are also available.

BULLETIN 712 AUTOMATIC
A.C. Combination Across-the-Line Starter with manually operated disconnect switch. A combination of Bulletin 609 mechanism and Bulletin 709 automatic solenoid starter.

BULLETIN 712 AUTOMATIC
A.C. Combination Across-the-Line Starter, in water-tight enclosure.

BULLETIN 712 AUTOMATIC
A.C. Combination Across-the-Line Starter, with disconnect switch in dust-tight enclosure for flour mills, elevators, etc.

BULLETIN 709 AUTOMATIC
A.C. Across-the-Line Starter — Form 1 — pressed steel cabinet, with Start and Stop buttons in cover for machine tools.

BULLETIN 709 AUTOMATIC
A.C. Across-the-Line Starter — Form 2 — without push buttons in cover, for operation with temperature or water level controls, etc.

BULLETIN 709 AUTOMATIC
A.C. Across-the-Line Starter —Form 3—with three-way lever switch, for automatic or hand control.

BULLETIN 709 AUTOMATIC
A.C. Across-the-Line Starter, in Type B, water-tight, cadmium plated enclosure, for creameries, breweries, bottling plants, etc.

BULLETIN 709 AUTOMATIC
A.C. Across-the-Line Starter, in Type D, dust-tight enclosure, for flour mills, grain elevators, etc.

BULLETIN 709 AUTOMATIC
A.C. Across-the-Line Starter, in Type G, explosion-proof enclosure, for operation in explosive atmospheres or gases.

BULLETIN 709 AUTOMATIC
A.C. Across-the-Line Starter, in Type H, explosion-proof enclosure, with switching unit immersed in oil, for use where explosive gases are also corrosive.